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ILMENITE AND RUTILE

(FINAL RELEASE)

GOVERNMENT OF INDIA
MINISTRY OF MINES
INDIAN BUREAU OF MINES

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India is endowed with large resources of heavy minerals which occur mainly along coastal stretches of the country and also in inland placers. Heavy mineral sands comprise a group of seven minerals, viz, ilmenite, leucoxene (brown ilmenite), rutile, zircon, sillimanite, garnet and monazite. Ilmenite ($FeO.TiO_2$) and rutile (TiO_2) are the two chief minerals of titanium. Titanium dioxide occurs in polymorphic forms as rutile, anatase (octahedrite) and brookite. Though, brookite is not found on a large-scale in nature, it is an alteration product of other titanium minerals. Leucoxene is an alteration product of ilmenite and is usually found associated with ilmenite.

RESOURCES

Ilmenite and rutile along with other heavy minerals are important constituents of beach sand deposits found right from Moti Daman-Umbrat coast (Gujarat) in the west to Odisha coast in the east. These minerals are concentrated in five well-defined zones:

* Over a stretch of 22 km between Neendakara and Kayamkulam, Kollam district, Kerala (known as 'Chavara' deposit after the main mining centre).
* Over a stretch of 6 km from the mouth of River Valliyar to Colachal, Manavalakurichi and little beyond in Kanyakumari district, Tamil Nadu (known as MK deposit).
* On Chatrapur coast stretching to about 18 km between Rushikulya river mouth and Gopalpur lighthouse with an average width of 1.4 km in Ganjam district, Odisha (known as 'OSCOM' deposit after IREL's Orissa Sands Complex).
* Brahmagiri deposit stretches for 30 km from Girala nala to Village Bhabunia with an average width of 1.91 km in Puri district, Odisha.
* Bhavanapadu coast between Nilarevu and Sandipeta with 25 km length and 700 m average width in Srikakulam district, Andhra Pradesh.

The AMD of the Department of Atomic Energy has been carrying out exploration of these mineral deposits. So far, about 3,890 km coastal tract and 160.72 sq km inland areas in Tamil Nadu and West Bengal have been investigated for over six decades by AMD. The ilmenite resources estimation for the areas explored up to 2012 has been completed and the resources are up from 520.38 million tonnes to 593.50 million tonnes (including leucoxene), inclusive of indicated, inferred and speculative categories. Resource estimation for the areas explored during 2012-15 is under progress. The most significant deposits which are exploitable and that which could attract the attention of Industry for large-scale operations are listed out in Table - 1.

The average grade of total heavy minerals in these deposits is 10-25% of which 30-35% is ilmenite. The overall statewise reserves of ilmenite and rutile which occur together in beach sand deposits are furnished in Table-1 A.

Table – 1 : Ilmenite Resources/Deposits in India

(In million tonnes)

State/Deposit	Ilmenite reserve
Andhra Pradesh	**82.28**
Bhavanapadu Hukumpet	10.18
Kakinada (Phase I-VIII)	13.84
Kalingapatnam	5.80
Narasapur	2.92
Nizampatnam	19.26
Srikurman (South)	8.60
Visakhapatnam (Bhimunipatnam)	2.88
Amalapuram (Phase I-III)	3.10
Pandurangapuram-Voderevu (Bapatla-Chirala coast)	10.39
Vetapalem Coast (Chirala coast)	5.31
Kerala	**94.83**
Chavara Barrier beach	13.17
Chavara Eastern Extension (Phase-I)	17.02
Chavara Eastern Extension (Phase-II)	49.26
Trikkunnapuzha-Thotapally Beach & Eastern Extension	9.50
Alapuzha-Kochi	5.88
Maharashtra	
Ratnagiri	3.68
Gujarat	
Moti Daman-Umbrat coast	2.77
Odisha	**71.09**
Brahmagiri (Phase IV)	37.98
Chatrapur	26.72
Gopalpur (Phase I-IV)	6.39
Tamil Nadu	**100.02**
Kudiraimozhi	22.86
Ovari-Periyatalai-Manapadu (Teri)	24.01
Sattankulam Teris	41.26
Cuddalore-Pudupattuchavadi	4.67
Vayakallur (Block I-IV)	3.54
Manavalakurichi	2.04
Midalam	1.64

Source: Department of Atomic Energy, Mumbai.

Table – 1 A : Resources of Ilmenite and Rutile

(In million tonnes)

State	Total in situ #
Ilmenite* : Total	**593.50**
Andhra Pradesh	163.05
Jharkhand/Bihar	0.73
Gujarat	2.77
Kerala	145.70
Maharashtra	3.74
Odisha	96.44
Tamil Nadu	179.02
West Bengal	2.05
Rutile : Total	**31.35**
Andhra Pradesh	10.25
Jharkhand/Bihar	0.01
Gujarat	0.02
Kerala	8.41
Odisha	4.47
Tamil Nadu	8.00
West Bengal	0.19

Source: *Department of Atomic Energy, Mumbai.*

 # Inclusive of indicated, inferred and speculative categories.

** Including leucoxene.*

As per the UNFC system as on 1.4.2010 compiled by IBM, the total resources of titanium minerals are placed at 394 million tonnes comprising ilmenite (335.6 million tonnes), rutile (13.4 million tonnes), leucoxene (1.0 million tonnes), anatase (3.3 million tonnes) and titaniferous magnetite (40.6 million tonnes).

EXPLORATION & DEVELOPMENT

IREL carried out exploration work at Chatrapur sand deposit, district Ganjam, Odisha for ilmenite & rutile, zircon, monazite, sillimanite and garnet. Commenced by AMD, DAE in the year 1969, a total of 2,464 hecters has been explored in the area. About 409 boreholes were drilled and mineralogical analysis of 2442 samples have been undertaken during the year 2014-15. Proposal to further drill 196 boreholes in 2015-16 is on the anvil. Furthermore, exploration work at the beach placer deposit of length 18 km along the coast of Bay of Bengal between River Rushikulya and Gopalpur with an average width of 1.4 km is under consideration.

GSI carried out exploration work for placer minerals in the terrritorial waters off north Bhuminipatnam, Andhra Pradesh for ilmenite, rutile, garnet, sillimanite and zircon. A total of 69 vibrocore seabed sediment samples varying in length from 0.13 m to 2.77 m with an average core length of 1.30 m were collected on grid of 1 km x 1 km within the water depth of 21 to 37 m. In territorial waters off Palur-Malud, Odisha 5 sand samples show dominance of heavy minerals like ilmenite, rutile, garnet, monazite and sillimanite.

In Kerala, GSI took up assessment of heavy minerals near the shore area of Attipara, near Thiruvananthapuram. The preliminary study shows that ilmenite is the major heavy mineral occurring in the sediments. Other minerals include zircon, sillimanite, garnet and monazite.

The survey and exploration carried out by AMD during 2008-09, 2009-10, 2010-11, 2011-12, 2012-13, 2013-14 and 2014-15 included parts of West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Maharashtra and Gujarat. The details of exploration activities carried out by AMD during 2014-15 are furnished in Table-2.

PRODUCTION AND PRICES

Ilmenite

The production of ilmenite at 641 thousand tonnes in 2014-15 decreased by 11% as compared to that in the preceding year. Tamil Nadu was the leading producer of ilmenite during the year under review, contributing 56% of the total production followed by Odisha 30% and Kerala 14 percent.

Rutile

The production of rutile at 16 thousand tonnes in 2014-15 registered increase by 16% as compared to that in the previous year. Odisha was the leading producer of rutile accounting for 47% of the total production followed by Tamil Nadu 30% and Kerala 23 percent.

Production and prices of ilmenite and rutile are furnished in Tables - 3 to 5.

Table – 2 : Exploration Activities by AMD for Ilmenite, Rutile, Monazite, Zircon and other Heavy Minerals, 2014-15

Location	Activity		Remark
	Reconnaissance survey (sq km)	Detailed survey (sq km)	
Parts of Odisha, Andhra Pradesh, Karnataka and Tamil Nadu	302.62 (Coastal tracts) Inland areas	14.4	Reconnaissance survey was undertaken to delineate potential heavy mineral concentrations along the coastal and inland tracts: (a) Bajrakot-Brahmapur tract, Ganjam District, Odisha recorded THM ranging from 0.67 to 56.27%. (b) Four inland red sediment occurrences exposed between Patsonapuram and Agastinuagan, Ganjam District, Odisha recorded THM ranging from 2.01% to 57.31%. (c) River Swanamukhi Confluence-Kothapatnam tract, SPSR, Nellore District recorded THM up to 1.55%. (d) Vaipar-Vembar-Naripaiyur tract, Thoothukudi and Ramanathapuram District, Tamil Nadu records very low THM of 5-15%. In addition to reconnaissance surveys, detailed survey was carried out in (i) Malikipuram, East Godavari district, Andhra Pradesh and (ii) Chavara, Kerala.

***Source**: Department of Atomic Energy, Mumbai.*

Table – 3 : Production of Ilmenite and Rutile 2012-13 to 2014-15 (By States)

(In tonnes)

State	2012-13	2013-14	2014-15(P)
ILMENITE			
India : Total	**738524**	**721959**	**640878**
Kerala	68555	95083	93059
Odisha	184570	146771	191680
Tamil Nadu	485399	480105	356139
RUTILE			
India : Total	**16527**	**13459**	**15617**
Kerala	3075	3468	3630
Odisha	7170	5759	7249
Tamil Nadu	6282	4232	4738

Table – 4 : Prices of Rutile 2012-13 to 2014-15

(₹ per tonne)

Year	Grade	Price	Remarks
IREL			
2012-13	Q	87000-148000	Ex-works, Bagged
	MK	87000-148000	Ex-works, Bagged
	OR	87000-148000	Ex-works, Bagged
2013-14	Q	73500-87000	Ex-works, Bagged
	MK	73500-87000	Ex-works, Bagged
	OR	73500-87000	Ex-works, Bagged
2014-15	Q	54800-73500	Ex-works, Bagged
	MK	54800-73500	Ex-works, Bagged
	OR	54800-73500	Ex-works, Bagged
KMML			
2011-12	-	87085	-
2012-13	-	110833	-
2013-14	-	67375	-
2014-15		**NA**	
V.V. Mineral (Average)			
2011-12	Premium & Standard	70610	Average
2012-13	-do-	116158	Average
2013-14	NA	102340	Average
2014-15	NA	55618	Average

Source: *Department of Atomic Energy, Mumbai.*
Note*: Q: Quilon; MK: Manavalakurichi; OR: Odisha*

Table – 5: Prices of Ilmenite 2012-13 to 2014-15

(₹ per tonne)

Period	Grade	Price	Remarks
IREL			
2012-13			
(Non SR/TiO_2)	Q	1700-22250	Ex-works, loose
	MK	16100-2100	Ex-works, loose
	OR	1500-17350	Ex-works, loose
(SR/TiO_2)	Q	12650-17900	Ex-works, loose
	MK	12450-17350	Ex-works, loose
	OR	12650-17750	Ex-works, loose
2013-14			
(Non SR/TiO_2)	Q	17000-22250	Ex-works, loose
	MK	16000-21000	Ex-works, loose
	OR	15000-17750	Ex-works, loose
(SR/TiO2)	Q	10500-14150	Ex-works, loose
	MK	10050-13700	Ex-works, loose
	OR	9000-12200	Ex-works, loose
2014-15			
(Non SR/TiO_2)	Q	15120-17000	Ex-works, loose
	MK	14320-16000	Ex-works, loose
	OR	13340-15000	Ex-works, loose
(SR/TiO_2)	Q	6370-10500	Ex-works, loose
	MK	6070-10050	Ex-works, loose
	OR	5440-9000	Ex-works, loose
KMML			
2011-12	12650	59.88% TiO_2	
2012-13	17900	59.88% TiO_2	
2013-14	NA		
2014-15	**NA**		
V.V. Mineral (Average)			
2012-13	NA	15269	
2013-14	NA	10562	
2014-15	NA	5916	
BMC			
2012-13	TiO_2 : 49-51%	8500 (US$140)	f.o.b.Thoothukudi
2013-14	TiO_2 : 49-51%	9475 (US$150)	f.o.b.Thoothukudi
2014-15	TiO_2 : 49-51%	8400 (US$140)	f.o.b.Thoothukudi
DCW Ltd			
2012-13	NA	20552	
2013-14	NA	17290	
2014-15	NA	10955	

Source: *Department of Atomic Energy, Mumbai.*
Note*: Q: Quilon; MK: Manavalakurichi; OR: Odisha*

MINING & PROCESSING

Mining and processing of beach sand is carried out by the IREL, a Government of India Undertaking; KMML, a Kerala State Government Undertaking and two Private Sector producers viz, M/s V. V. Mineral, Thoothukudi (Tamil Nadu) and M/s Beach Minerals Co. Pvt. Ltd, Kuttam (Tamil Nadu). Exploitation work of beach sand deposits located at Chavara in Kerala, Gopalpur in Odisha and Manavalakurichi in Tamil Nadu by IREL is under progress.

At IREL, Chavara, Beach Sand was collected over a stretch of 22 km between Neendakara and Kayamkulam in Kerala and was transported to plant site. The unit has adopted wet mining operations involving use of two Dredge and Wet Concentrator (DWC) of 100 tph capacity each to exploit the inland deposits away from the beaches. Chavara ilmenite is the richest in TiO_2 content (75.8% TiO_2) and has great demand in India and abroad for manufacture of pigments.

At Manavalakurichi, the deposit is spread over 300 hectares at Thuthoor-Ezudesam villages, Vilavancode tehsil, district Kanyakumari, Tamil Nadu. All the raw sand required for the mineral separation plant to operate to its full capacity is collected from nearby beaches. Deposits are also exploited by DWC of 100 tph capacity. Manavalakurichi is next to Chavara in terms of TiO_2 content which is more than 55%.

The sand deposits of OSCOM at Chatrapur in district Ganjam extend along the coast of Bay of Bengal with an average width of 1.4 km and average depth of 7.5 m. Mining operations involve suction dredging to 6 m depth below water level on a much larger scale (500 tph) augmented by a smaller sized (100 tph) supplementary. The ilmenite from OSCOM is inferior in grade in terms of TiO_2 content (50%) in comparison to Chavara and Manavalakurichi. The Synthetic Rutile Plant of OSCOM is presently not working. As a result, the majority of OSCOM ilmenite produced of late is routed to the international market as feedstock for production of both slag grade and anatase grade pigment.

In dry mining, beach washings laden with 40-70% Heavy Minerals (HM) are collected through front end loaders and bulldozers for further concentration to 90% HM at land-based concentrators. Though dry mining is very simple and economic, there is considerable opposition by local people for this form of mining for reasons that removal of sand would expose the land area to sea erosion. Therefore, collection of beach washings has reduced significantly in recent past.

As an alternate approach, IREL has adopted wet mining involving dredging and wet concentration (DWC) from inland areas away from the beach lines. In this mode, an artificial pond is created, the sand bed is cut and the slurry is pumped to spiral concentrator for removal of quartz. Manavalakurichi was the first plant to install a DWC (100 tph) followed by one (500 tph) at OSCOM and two (each 100 tph) at Chavara. The concentrate (90% HM) of beach washing plant from DWC is further upgraded to 97% HM grade at a Concentrate Upgradation Plant (CUP) before sending it to Mineral Separation Plant (MSP).

KMML collects seasonal accretions of heavy mineral sand from the beach front. The pit so formed gets filled by fresh accretions of heavy mineral sand. The mineral sand is collected using bulldozers and wheel loaders and transported in tippers to Mineral Separation Plant.

The mineral separation plants use variety of equipment, such as, gravity concentrators, high tension electrostatic separators and magnetic separators. Making use of difference in physical properties like electrical conductivity, magnetic susceptibility and difference in specific gravity, etc., individual minerals like ilmenite, rutile, zircon, sillimanite and garnet are separated. The mined beach sands are pre-concentrated and dried after sieving (30-mesh) to separate the heavies from rejects. The heavy minerals are passed through electrostatic separators where conducting minerals – ilmenite and rutile – are separated from other non-conducting minerals. Ilmenite and rutile are further subjected to low-intensity magnetic separators where magnetic fraction - ilmenite is separated from rutile. Similarly, non-conducting fractions are subjected to high-intensity magnetic separators where weak magnetic fraction (monazite and garnet) is separated from non-magnetic fraction (zircon and sillimanite). The fractions are further processed on wind tables to separate garnet from monazite and sillimanite from zircon.

IREL carried out trial runs for expansion of capacity of ilmenite to 2,00,000 tonnes at Chavara plant in Kerala and has commissioned it successfully. The Company has plan to expand MSP capacity at OSCOM to produce 4.7 lakh tonnes of ilmenite and associated minerals by the end of 2017. Trimex Group is understood to be gearing up to begin its 2,00,000 tpy ilmenite, 6,000 tpy zircon, 60,000 tpy garnet and 50,000 tpy sillimanite along with rutile project in Srikakulam district, Andhra Pradesh.

Installed capacity and production of ilmenite, rutile and other associated heavy minerals by various separation plants are furnished in Table-6.

Table – 6 : Installed Capacity & Production of Ilmenite, Rutile and Other Heavy Minerals, 2012-13 to 2014-15

(In tonnes)

Company/ Location	Mineral	Specification	Installed capacity (tpy)	Production		
				2012-13	2013-14	2014-15
Indian Rare Earths Ltd						
Manavalakurichi,	Ilmenite	55% TiO_2 (min)	90000	33260	29050	33287
Distt. Kanyakumari,	Rutile	94% TiO_2 (min)	4000	1381	981	1260
Tamil Nadu.	Zircon	65% ZrO_2+HfO_2 (min)	10000	2688	2078	3166
	Sillimanite	58% Al_2O_3	–	-	-	-
	Monazite	96% pure	6000	-	491	2825
	Garnet	97% pure (min)	8500	10240	6178	10397
Chavara,	Ilmenite	58% TiO_2 (min)	200000	23309	32233	28009
Distt. Kollam,	Rutile	95% TiO_2 (min)	11400	1224	1138	992
Kerala.	Zircon	65% ZrO_2+HfO_2 (min)	17500	1992	2132	1738
	Rare Earths	–	4500*	-	-	-
	Sillimanite	58% Al_2O_3 (min)	24500	4936	3840	6943
	Leucoxene	–	–	105	-	-
	Zirflour	-200 mesh	6000	1161	34	19
	(includes	-300 mesh	500	940	595	848
	Microzir)					
Orissa Sands Complex,	Ilmenite	50.25% TiO_2 (min)	220000	184570	138115	200102
Distt. Ganjam,	Rutile	94.25% TiO_2 (min)	10000	7170	5766	7249
Odisha.	Zircon	64.25% ZrO_2+HfO_2 (min)	5000	6235	4576	5769
	Sillimanite	56.5% Al_2O_3 (min)	10000	12314	11722	18311
	Garnet	93.5% garnet (min)	24000	23898	19092	11999
Kerala Minerals & Metals Ltd						
Chavara,	Ilmenite	59.88% TiO_2	61600	43403	45240	62850
Distt. Kollam.	Rutile	93.20% TiO_2	4400	2600	1850	2330
Kerala.	Zircon	64.81% ZrO_2	6500	5213	3960	3635
	Sillimanite	NA	3600	339	1265	1270
V.V. Mineral						
Distt. Thoothukudi,	Ilmenite	51.0-52.5% TiO_2	450000	405700	447000	211662
Tamil Nadu.	Rutile	95% TiO_2 (min)	12000	1500	7000	3580
	Zircon@	66% ZrO_2+HfO_2 (min)	18000	6200	6250	-
	Zircon-sillimanite	NA	24000	4600	11500	-
	Garnet	NA	150000	_	-	-
Beach Minerals Co. Pvt. Ltd						
Kuttam,	Ilmenite	KU grade 49-51% TiO_2	150000	36000	36500	49090
Distt. Tirunelveli,						
Tamil Nadu.						

Source: *Department of Atomic Energy, Mumbai and IREL.*
** In terms of rare earths chloride.*
@ Besides, 4,600 tonnes, 11,500 tonnes and 6,640 tonnes production of zircon-sillimanite have also been reported during 2011-12, 2012-13 and 2013-14 respectively.

INDUSTRY

For manufacture of titanium dioxide pigment, ilmenite is first treated chemically to obtain upgraded ilmenite, commonly called as synthetic rutile. There are two major pigment production processes namely chloride process and sulphate process depending on different operating characteristics and feedstock requirements. Plants employing chloride process consume high TiO_2 content feedstocks like synthetic rutile and chloride slag. On the other hand, plants employing the sulphate process use lower grade ilmenite and sulphate slags.

Ilmenite obtained from Mineral Separation Plant (MSP) is chemically treated to remove impurities, such as, iron to obtain synthetic rutile (90% TiO_2) in Synthetic Rutile Plant (SRP). Indian Synthetic Rutile Plants are based on reduction roasting followed by acid leaching with or without generation of hydrochloric acid. Plants of IREL (OSCOM) and KMML depend on acid regeneration from the leach liquor while those of Cochin Minerals & Rutile Ltd (CMRL) and DCW use fresh acid and recover ferric chloride from the leach liquor for its use in water purification.

At OSCOM plant of IREL, reduction-roasting of ilmenite with coal is followed by leaching with HCL to separate iron as soluble ferrous chloride. The leached ilmenite is calcined to yield synthetic rutile and the acidic leach liquor is treated in an acid regeneration plant to recover HCL for recycling with iron oxide as waste. The unit stopped production in 1997 as it was not viable economically. IREL intends to set up titanium slag plant based on OR ilmenite at Odisha and has signed an MoU with NALCO for this purpose. Depending upon feasibility, further value addition to TiO_2 pigment and Ti sponge shall be taken up, subsequently.

The KMML is manufacturing rutile grade titanium dioxide pigment by chloride route at its Sankaramangalam plant near Chavara in Kerala. The project for the production of one lakh tonne of TiO_2 in a phased manner is under implementation. The Company also has plans to enhance pigment capacity to 60,000 tpy for which detailed project report is under preparation. In 2009, the Company had developed Nano Titanium Dioxide particles on laboratory scale and in July 2011, India's first commercial plant for synthesis of nano-titanium dioxide was commissioned. KMML is setting up a plant for producing 500 tpa of Titanium sponge with technology from DMRL. The Company further has plans to expand the capacity to 1,000 tpa. The production of titanium sponge during 2011-12 & 2012-13 was 15.184 tonnes & 88.296 tonnes, respectively.

The DCW Ltd procures ilmenite from Manavalakurichi which is then roasted with coke fines to convert Fe_2O_3 into FeO. The reduced ore is leached with concentrated hydrochloric acid to remove oxides of iron and other metals. The leached ore is washed and calcined to get upgraded ilmenite which contains more than 95% TiO_2. The upgraded ilmenite is micronised to 2 microns by using high-pressure steam. This is marketed as Titox. The liquor from ilmenite leaching process contains fine TiO_2 particles and chlorides. The TiO_2 recovered by filtration & washing in filter process is marketed as Utox. The Company has plans to increase the plant capacity to 48,000 tpy and also to install facilities for the manufacture of ferrite grade iron oxide from the effluent of the ilmenite plant.

Cochin Minerals and Rutile Ltd (CMRL), which began production at its 10,000 tpy synthetic rutile plant in Kerala in 1990 as a 100% EOU, has gradually raised the production capacity to around 45,000 tpy since 2008-09 for exports. It also has ferric chloride & ferrous chloride plants having capacities 24,000 tpy & 72,000 tpy, respectively.

The Travancore Titanium Products Ltd (TTPL), a Kerala State Govt. Undertaking, manufactures titanium dioxide pigment by sulphate process at its plant at Kochuveli, Thiruvananthapuram. Ilmenite is reacted with sulphuric acid in digesters and a porous cake is formed. The mass in the solid form is dissolved in dilute sulphuric acid to get titanium in solution as titanium oxysulphate along with other metallic ingredients in ilmenite as their sulphate. The liquor is reduced using scrap iron, when ferric iron gets completly reduced to the ferrous state. The liquor is clarified, concentrated and boiled to precipitate the titanium content as hydrated titania which is then filtered by vacuum filters and calcined. Sulphuric acid required for captive consumption is produced at site using elemental sulphur. Till recently, TTPL was the only unit producing anatase grade titanium dioxide pigment in India. TTPL has capacity to produce 17,000 tpy of titanium dioxide and with plans to modernise and diversify in stages the Company has chalked out targets to produce both anatase and rutile grades titanium dioxide pigment.

Tata Steel has proposed a project to produce 1,00,000 tonnes per year titanium dioxide from ilmenite mined from beach sands of Tirunelveli and Thoothukudi districts in southern Tamil Nadu.

NMDC has signed an MoU with KSIDC and IREL for setting up a synthetic rutile plant in Kerala. The Company has applied for prospecting licences in various areas in Odisha, Kerala and Tamil Nadu and sought Swedish technology for mineral separation plant. The Beach Minerals Co. Pvt. Ltd also has plans for production of synthetic rutile from ilmenite. Presently, it only has facility of pilot plant. M/s V. V. Mineral has plans to set-up a 5 lakh tpy titanium pigment plant. The project is at approval stage.

Present domestic titanium metal production is negligible. KMML has set-up a 500 tpy titanium sponge plant with Defence Metallurgical Research Laboratory (DMRL) technology and first batch of titanium was delivered in September 2011. The plant will be further expanded to 1,000 tpy. IREL is to set-up a 10,000 tpy titanium sponge plant at OSCOM for which proposals have been invited on build, operate and own basis. IREL intends to set-up titanium slag plant based on ilmenite from OSCOM, Odisha and has signed an MoU with NALCO for this purpose. Depending upon feasibility, further value addition to TiO_2 pigment and titanium sponge will be taken up, subsequently. Titanium sponge is imported by Mishra Dhatu Nigam Ltd Midhani for further processing in the country.

The available data on plantwise capacities & production of synthetic rutile and TiO_2 pigment from 2012-13 to 2014-15 are furnished in Table-7.

Table –7 : Installed Capacity and Production of Synthetic Rutile/Titanium dioxide Pigment, 2012-13 to 2014-15

(In tonnes)

Plant	Location	Specification	Installed capacity (tpy)	Production		
				2012-13	2013-14	2014-15
Total			**243000** (Synthetic rutile)	**59426** (Synthetic rutile)	–	-
			74800 (TiO_2 Pigment)	**23459** (TiO_2 Pigment)	–	-
IREL	Orissa Sands Complex, Distt. Ganjam, Odisha.	90.5% TiO_2 (min)	100000 (Synthetic rutile)	–	–	–
KMML	Chavara, Distt. Kollam, Kerala.	92%-93% TiO_2	50000 (Synthetic rutile)			
			40000 (TiO_2 - Chloride Process)	-	-	-
DCW Ltd	Sahupuram, Distt. Thoothukudi, Tamil Nadu.	95% TiO_2	48000 (Synthetic rutile)	40696	-	-
CMRL	Edayar, Distt. Ernakulam, Kerala.	96.5% TiO_2	45000 (Synthetic rutile)	18730	–	-
TTPL	Kochuveli, Distt. Thiruvananthapuram, Kerala.	97.5% TiO_2	17000 (TiO_2-Sulphate Process)	11550		- –
VVTi Pigments Pvt. Ltd* (formerly Kilburn Chemicals)	Thoothukudi, Tamil Nadu.	98% TiO_2 (min)	13000 (TiO_2-Sulphate Process)	11909	12243	131182
Kolmar Chemicals Ltd	Kalyani, Distt. Nadia, West Bengal.	NA	4800 (TiO_2-Sulphate Process)	NA	–	-

Source: *Department of Atomic Energy, Mumbai and individual companies.*
Note: *KMML captively consumes synthetic rutile while CMRL and DCW export synthetic rutile.*
* *Including Kilburn Chemicals.*

USES

Ilmenite is used mainly for the manufacture of ferro-titanium and synthetic rutile i.e., titanium dioxide, a white pigment. The unique combination of superior properties of high refractive index, low specific gravity, high hiding power and opacity and non-toxicity enable titanium dioxide in its application in the manufacture of all types of white and pastle shades of paints, white-walled tyres, glazed papers, plastics, printed fabrics, flooring materials like linoleum, pharmaceuticals, soaps, face powders and other cosmetic products. Besides, its non-toxic nature facilitate its use in cosmetics, pharmaceuticals, and even in foodstuffs as well as in toothpastes. Titanium dioxide is used in the manufacture of many sunscreen lotions and creams because of its non-toxicity and ultra violet absorption properties. Synthetic rutile is used for coating welding electrodes as flux component and for manufacture of titanium tetrachloride which in turn is used in making titanium sponge. Synthetic rutile is also used as

ingredient of special abrasives. Titanium metal is a versatile material with exceptional characteristics. The lightness, strength and durability of the metal make it an essential metal for the Aerospace Industry. It is also used in desalination and power generation plants and corrosive chemical industries because of its inertness and resistance to corrosion and high thermal conductivity. Its non-reactive property makes titanium metal one of the few materials that can be used in the human body for orthopaedic use and in pacemakers.

CONSUMPTION

The ilmenite consumption is placed at 20,300 tonnes in 2014-15. The bulk of ilmenite is consumed in the manufacture synthetic rutile (99%). Moderate proportions are consumed by welding electrode and ferro-alloys Industry. The consumption of rutile in 2014-15 was 25,800 tonnes compared to 26,000 tonnes in 2013-14. Bulk consumption was in Paint Industry followed by Electrode Industry. About 84% consumption was in Iron and Steel Industry and 15% in Alloy Steel and Foundry Industries (Table - 8).

Table – 8 : Consumption* of Ilmenite, Rutile and Ferro-Titanium, 2012-13 to 2014-15 (By Industries)

(In tonnes)

Industry	2012-13(R)	2013-14(P)	2014-15(e)
ILMENITE			
All Industries	**188800**	**188600**	**203000**
Chemicals	187000(5)	187000(5)	201400(5)
Electrode	1500(28)	1300(28)	1300(28)
Ferro-alloys	300(5)	300(5)	300(5)
Paint	++(2)	++(2)	++(2)
Refractories	++(1)	++(1)	++(1)
RUTILE			
All Industries	**26100**	**26000**	**25800**
Electrode	8800(50)	8800(50)	8500(53)
Paint	16600(12)	16600(12)	16600(12)
Paper	300(2)	300(2)	300(2)
Others (Cosmetic, Electrical, Ferro-alloys)	400(5)	300(5)	400(4)

Figures rounded off.
Figures in parentheses denote the number of units in organised sector reporting consumption.*
*(*Paucity of information, hence the data on consumption may not be complete).*

POLICY

The Government of India had notified in October 1998, a policy on exploitation of beach sand minerals in the country, which inter alia allows participation of the Private Sector with or without foreign companies subject to conditions stipulated. This will encourage further exploitation of mineral deposits through a judicious mix of Public & Private Sector participation including foreign collaboration. The ceiling on FDI on mining of titanium minerals has been raised to 100 percent.

Joint ventures with foreign participation were being pursued by IREL for production of value-added products, keeping in view the Beach Sand Mineral Policy of the Government.

The minerals, ilmenite and rutile, were grouped as 'prescribed substances' as per notifications issued under the Atomic Energy Act, 1962. However, as per the revised list of Prescribed Substances, Prescribed Equipment and Technology notified by Department of Atomic Energy vide S.O.No.61(E), dated 20.1.2006, the titanium ore minerals like ilmenite, rutile and leucoxene have been delisted as prescribed substances by the Department of Atomic Energy subject to the note as below:

"These minerals shall remain prescribed substances only till such time the policy on Exploration of Beach Sand Minerals notified vide Resolution No.8/1(1)/97-PSU/1422, dated 6.10.1998, is adopted/revised/modified by the Ministry of Mines or till 1.1.2007, whichever occurs earlier and shall cease to be so thereafter".

As per the Foreign Trade Policy, 2009-2014 and the policy on exports and imports, titanium ores and concentrates under heading 2614 (comprising ilmenite unprocessed and upgraded, i.e., beneficiated ilmenite including ground ilmenite) and rutile sand can be imported/exported freely.

SUBSTITUTES

There are no cost-effective substitutes for titanium dioxide pigments. Synthetic rutile made from ilmenite can be substituted for natural rutile. Nickel steels, stainless steels and some non-ferrous metal alloys can sometimes replace titanium alloys in industrial uses although at the expense of performance or economics. Tungsten carbide competes with titanium carbide for surface cutting machine tools. Titanium slag competes with ilmenite and rutile.

Environmental awareness indicates that titanium dioxide plants are likely to use chloride technology in future as it produces much less quantity of waste products. Synthetic rutile or slag (made from ilmenite) is likely to be used as feed in increasing amount. There

is also a strong pressure to reduce the radioactive content of feedstocks because it affects the marketability of beach sand ilmenite. Titanium alloys could be replaced in aerospace applications by lithium-aluminium alloys or carbon-epoxy composites.

WORLD REVIEW

World resources of anatase, ilmenite and rutile are more than 2 billion tonnes. World reserves of ilmenite are estimated at 740 million tonnes in terms of TiO_2 content. Major reserves are in China (27%), Australia (19%), India (11%), South Africa (9%), Brazil and Madagascar (6% each), Norway (5%) and Mozambique (2%). The world reserves of rutile are 54 million tonnes in terms of TiO_2 content. Major rutile reserves are located in Australia (41%), followed by South Africa (15%), India (14%) and Ukraine (5%).

World production of ilmenite and rutile concentrates was 12.58 million and 0.75 million tonnes, respectively, in 2014. Canada contributed 20% of ilmenite production, followed by Australia (12%) and South Africa & China (about 9% each). Australia produced 40% of world rutile output, followed by South Africa (18%), Ukraine (13%) and Sierra Leone (11%). World reserves and production of titanium minerals, viz, ilmenite and rutile, are furnished in Tables - 9 to 11, respectively.

Table – 9 : World Reserves of Ilmenite and Rutile (By Principal Countries)

(In '000 tonnes of contained TiO_2)

Country	Reserves	
	Ilmenite	Rutile
World: Total (Ilmenite+Rutile) : 794000		
World: Total (Rounded)	**740000**	**54000**
Australia	140000	22000
Brazil	43000	-
Canada	31000	–
China P Rep.	200000	–
India*	85000	7400
Kenya	54000	13000
Madagascar	40000	–
Mozambique	14000	-
Norway	37000	–
South Africa	63000	8300
Ukraine	5900	2500
USA	2000	–
Vietnam	1600	–
Other countries	26000	400

***Source**: Mineral Commodity Summaries, 2015.*

** As per NMI, the total resources of titanium minerals in India are estimated at about 349.49 million tonnes.*

Table – 10 : World Production of Ilmenite (By Principal Countries)

(In '000 tonnes)

Country	2012	2013	2014
World: Total (wt. of conc.)	**11442**	**11548**	**12582**
Australia Ilmenite	1344	1342(e)	1340
Leucoxene	228	230(e)	230(e)
Brazil	69	78	80(e)
Canada(e)@	2700	2800	2500
China P Rep.(e)	1100	1100	1100
India**	739	740e	740e
Madagascar	562	562	334
Mozambique	575	720	855
Norway	831	826	864
Russia	125	150	178
Senegal	0	0	1005
South Africae	1203	1070	1105
USAe	300	200	100
Ukraine(e)	600	600	600
Vietname	978	1088	1100(e)
Sri Lanka	45	43	135
Kenya	0	0	282
Other countries	44	48	34

***Source**: World Mineral Production, 2009 & 2014.*

***Note**: Some ilmenite is converted to synthetic rutile in Australia, India, Japan, Taiwan and USA.*

@ Canada produces some ilmenite which is sold as such and not processed into slag, but tonnages are small.

Table – 11 : World Production of Rutile (By Principal Countries)

(In '000 tonnes)

Country	2012	2013	2014
World: Total (wt. of conc.)	**849**	**1244**	**757**
Australia	439	232	300e
India	17	16e	16e
Kazakhstane	17	17	17
Sierra Leone	94	120	83
South Africa	141	734	133
Sri Lanka	2	3	37
Ukraine(e)	100	100	100
Other countries	40	21	71

***Source**: World Mineral Production, 2009 & 2014.*

World production of TiO_2 contained in titanium mineral concentrates was 9.85 million tonnes in 2014, which reportedly decreased by 8% from that of 2013. The leading sources of world imports of titanium mineral concentrates were Australia, South Africa, China and Canada.

Metal

Commercial production of titanium metal involves the chlorination of titanium-containing mineral concentrates to produce titanium tetrachloride ($TiCl_4$), which is reduced with magnesium (Kroll process) or sodium (Hunter process) to produce a commercially pure form of titanium metal. The metal formed has a porous appearance and is referred to as sponge. Titanium ingot and slab are produced by melting titanium sponge or scrap or a combination of both, usually with various other alloying elements.

Pigment

Global TiO_2 pigment production capacity was estimated to be 5.7 million tonnes per year. TiO_2 pigment produced is categorised by crystal form as either anatase or rutile. Rutile pigment is less reactive with the binders in paint when exposed to sunlight than the anatase pigment and is preferred substance in outdoor paints. Anatase pigment has a bluer tone than rutile, is somewhat softer, and is used mainly in indoor paints and in paper manufacturing. Depending on the manner in which it is produced and subsequently finished, TiO_2 pigment can exhibit a wide range of functional properties, including dispersion, durability, opacity and tinting.

Australia

Iluka Resources Ltd produced 1,77,000 tonnes of rutile and 2,71,000 tonnes of ilmenite from its operations in Australia, an increase of 40% and a decrease of 31%, respectively, compared with that of 2013. All of Iluka's synthetic rutile kilns were idle in 2014 in response to reduced market demand

Atlas and Boonanarring deposits in the Perth Basin, Western Australia were expected to produce 89,000 tonnes per year of ilmenite and 9,000 tonnes per year of rutile and 5,400 tonnes per year of leucoxene over a 10 year mine life.

China P Rep.

China exported 5,691 tonnes of titanium sponge in 2014, an increase of 41% from that of previous year based on increased demand for lower grade sponge from South Korea steelmakers. Imports of titanium concentrate totalled 2,02 million tonnes in 2014 a decrease of 11% from 2013.

Japan

Japan produced 30,900 tonnes of titanium sponge in 2014, a decrease of 27% from that of 2013. Exports of titanium sponge were about 15,800 tonnes in 2014, a decrease of 9% from those of 2013 due to lower demand from global Aircraft Industry for titanium sponge. Domestic shipments of 19,100 tonnes showed an increase of 11% from those of 2013, which could be attributed to demand in plate heat exchanger and tubing in electric generation plants.

Kazakhstan

The Ust-Kamenogorsk Titanium Magnesium Plant produced about 9,000 tonnes of titanium sponge in 2014, a decrease of 25% from that of 2013. The cutback in production, which began in 2013, was a deliberate company response to overstocking and inventory oversupply in the global titanium sponge market.

Kenya

Base Resources Ltd had produced 3,74,000 tonnes of ilmenite and 59,500 tonnes of rutile during 18 months period since its start up. Base Resources was expected to produce 3,60,000 tonnes of ilmenite and 80,000 tonnes of rutile per year during the first six years of production.

Madagascar

World Titanium Resources Ltd (WTR) has an estimated ore reserve at its Ranobe deposit in the Toliara Sands Project in southwest Madagascar of 161 million tonnes containing 8.2% heavy minerals. WTR is expected to produce 4,07,000 tonnes per year of ilmenite and 44,000 tonnes per year of zircon-rutile concentrate over a mine life of 21 years.

FOREIGN TRADE

Exports

As per the data from DGCI & S, Kolkata, exports of titanium ores & conc. increased to 0.77 million tonnes in 2014-15 as compared to 0.68 million tonnes in the preceding year. Exports in 2014-15 comprised ilmenite (775,192 tonnes), rutile (4,332 tonnes) and other titanium ores (74 tonnes). Main destinations were China (53%), Netherlands (18%) and Japan (12%).

Exports of titanium and alloys (including waste & scrap) were 174 tonnes in 2014-15 as compared to 118 tonnes in the previous year. Exports were mainly to USA. Exports of titanium oxide and dioxide (total) decreased to 37,924 tonnes in 2014-15 from 38,206 tonnes in 2013-14. Out of the total exports in 2014-15, those of titanium dioxide were 5,157 tonnes and exports of titanium oxides (other than titanium dioxides) were 32,767 tonnes (Tables-12 to 19).

Imports

As per the data from DGCI&S, imports of titanium ores & conc. decrease to 51,991 tonnes in 2014-15 as compared to 91,775 tonnes in the preceding year. Out of the total imports of titanium ores & conc. in 2014-15, those of ilmenite were 40,894 tonnes, rutile 8,736 tonnes and other titanium ores were 2,361 tonnes. Main suppliers were Mozambique, Indonesia, Australia, South Africa and Sri Lanka.

Imports of titanium and alloys (including waste & scrap) were 2,008 tonnes in 2014-15 as compared to 1,536 tonnes in the previous year. Imports were mainly from Kazakhstan, China, USA and UK. Imports of titanium oxide and dioxide (total) were 19,178 tonnes in 2014-15 as compared to 17,445 tonnes in the preceding year. Imports were mainly from China (32%), Korea, Rep. of (23%) and Germany (10%). Bulk of these imports were of titanium dioxide (17,574 tonnes) and titanium oxides (other than Titanium Oxides) were 1,604 tonnes in 2014-15 (Tables - 20 to 27).

Table – 12 : Exports of Titanium Ores & Conc. (Ilmenite) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**686264**	**8731824**	**775192**	**6956324**
China P Rep.	311065	3814153	411450	3414625
Japan	78632	1793452	93120	1349411
Netherlands	169190	1756606	137343	1070970
Malaysia	89280	995616	79354	715576
Korea, Rep. of	21800	206454	53900	405144
Bangladesh	31	970	19	540
Kenya	-	-	6	55
Australia	-	-	++	2
Germany	++	1	-	-
Other countries	16266	164572	++	1

Table – 13 : Exports of Titanium Ores & Conc.: Total (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**687923**	**10412481**	**779598**	**7179648**
China P Rp	311065	3814153	411870	3435382
Japan	78634	1794080	95228	1447215
Netherlands	169296	1764731	137343	1070970
Malaysia	89320	998296	79354	715577
Korea, Rep. of	21800	206454	53941	407478
Iran	1448	1658204	1148	64153
Belgium	4056	56227	228	12489
Bangladesh	41	2257	160	9524
UAE	78	299	137	5051
Kenya	10	1200	75	4976
Other Countries	12175	116580	114	6833

Table – 14 : Exports of Titanium Ores & Conc. (Rutile) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1619**	**1678038**	**4332**	**217945**
Japan	2	628	2108	97804
Iran	1224	1654314	1148	64153
China	-	-	420	20757
Belgium	52	3489	228	12489
Bangladesh	-	-	108	6717
UAE	78	299	137	5051
Korea, Rep. of	-	-	41	2335
Kenya	-	-	34	2112
Bulgaria	-	-	26	1599
Indonesia	1	126	28	1453
Other countries	262	19182	54	3475

Table – 15 : Exports of Titanium Ores & Conc. (Others) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**40**	**2619**	**74**	**5379**
Bangladesh	10	1286	33	2266
Kenya	10	1200	35	2809
Maldives	-	-	4	142
Indonesia	-	-	1	119
Pakistan	-	-	1	38
Germany	-	-	++	4
Malaysia	-	-	++	1
Other countries	20	133	-	-

Table – 16 : Exports of Titanium & Alloys (Incl. Waste & Scrap) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**118**	**163635**	**174**	**197302**
Malaysia	2	44040	2	29748
USA	41	21528	121	46370
Italy	++	109	3	18664
Ukraine	5	16661	7	16296
Saudi Arabia	8	14867	3	11130
Philippines	1	13099	2	15886
Qatar	1	2928	++	6140
Canada	++	33	1	4563
UAE	1	8958	1	3777
UK	41	7886	29	25293
Other countries	18	33326	5	19435

Table – 17 : Exports of Titanium oxide & Dioxide : Total (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**38206**	**3447972**	**37924**	**2286503**
Japan	25596	1920812	23980	1204302
USA	3277	427959	1456	182155
Italy	2168	325981	1894	267505
China	2716	163827	7721	310798
Iran	984	160162	399	71523
Turkey	467	65753	121	15293
Nigeria	283	41276	498	70220
Malaysia	51	5915	1092	63590
Thailand	300	37633	153	16100
UAE	170	30016	220	23925
Other countries	2194	268638	390	61092

Table – 18 : Exports of Titanium dioxide (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**9054**	**1285335**	**5157**	**710758**
USA	3128	415952	1291	171091
Italy	2060	301398	1768	239796
Iran	984	160162	399	71523
Japan	516	71241	523	65426
Turkey	443	64271	103	13895
Nigeria	283	41276	379	58079
Thailand	300	37633	153	15962
Sri Lanka	59	9179	68	10319
Tanzania	28	4576	49	9073
UAE	154	20333	220	23906
Other countries	1099	159314	204	31688

Table – 19 : Exports of Titanium oxide (Other than Titanium Dioxide) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**29152**	**2162637**	**32767**	**1575745**
Japan	25080	1849571	23457	1138877
China	2700	161297	7681	309187
Malaysia	-	-	1092	63590
Italy	108	24584	126	27709
USA	149	12007	165	11064
Nigeria	-	-	119	12141
Chile	-	-	18	4115
Morocco	-	-	22	4497
Tanzania	1	185	6	1531
Russia	-	-	24	1487
Latvia	-	-	20	1412
Other countries	1114	114993	55	4250

Table – 20 : Imports of Titanium Ores & Conc. : Total (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**91775**	**1933433**	**51991**	**971521**
Mozambique	76188	1043133	32567	322152
Australia	9914	663692	5660	292110
Sri Lanka	4000	118020	1609	81833
South Africa	920	62379	3522	172263
Ukraine	364	25988	106	4885
Sierra Leone	100	6853	24	1442
Vietnam	104	6399	125	5548
China	52	3080	104	5540
Germany	45	2280	2	246
Indonesia	-	-	8252	85157
Other countries	88	1609	20	345

Table – 21 : Imports of Titanium Ores & Conc. (Ilmenite) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**79276**	**1091737**	**40894**	**408590**
Mozambique	76188	1043133	32567	322152
Sri Lanka	3000	46616	25	212
Indonesia	-	-	8252	85157
Ukraine	-	-	28	624
Germany	5	659	2	246
Malaysia	-	-	20	199
Other countries	83	1329	-	.-

Table – 22 : Imports of Titanium Ores & Conc. (Rutile) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**10078**	**682300**	**8736**	**447124**
Australia	8011	539990	4550	237324
Sri Lanka	900	64006	1134	60063
South Africa	634	42843	2898	141147
Ukraine	252	18116	78	4262
China	52	3080	52	2887
Sierra Leone	100	6853	24	1441
Other countries	129	7412	++	++

Table – 23 : Imports of Titanium Ores & Conc. (Others) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**2421**	**159396**	**2361**	**115807**
Australia	1903	123702	1110	54787
South Africa	286	19536	624	31116
Sri Lanka	100	7398	450	21558
Vietnam	-	-	125	5548
China	-	-	52	2654
Singapore	-	-	++	144

Table – 24 : Imports of Titanium & Alloys (Incl. Waste & Scrap) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**1536**	**3161133**	**2008**	**3360378**
USA	137	476248	279	766775
China	330	554576	343	466448
UK	87	334533	164	440201
Italy	300	804155	137	307203
Kazakhstan	134	128376	405	279968
Ukraine	6	18455	91	173251
Japan	54	82207	166	172428
France	15	83072	37	171376
Russia	309	364480	81	154256
Germany	123	176320	123	133040
Other countries	41	138531	183	295432

Table – 25 : Imports of Titanium oxide & Dioxide : Total (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**17445**	**2999969**	**19178**	**3029044**
China	5442	753112	6072	788307
Korea, Rep. of	2898	500900	4481	674238
Germany	2408	577139	1934	452876
USA	1308	251320	1389	265207
Japan	876	221435	996	241829
Czech Republic	1318	199809	1520	206615
Ukraine	1600	203913	1700	196505
Italy	502	91124	229	40189
Mexico	55	10887	120	23441
Singapore	31	6606	130	21848
Other countries	1007	183724	607	117989

Table – 26 : Imports of Titanium dioxide (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**16875**	**2919648**	**17574**	**2824279**
China	4968	706132	4786	671137
Germany	2385	569811	1769	411692
Korea, Rep. of	2898	500900	4481	674193
USA	1298	248396	1370	261673
Japan	864	211105	972	230982
Ukraine	1600	203913	1700	196505
Czech Republic	1318	199809	1520	206615
Italy	482	86578	189	31200
Chinese Taipei/Taiwan	225	41824	112	20957
Mexico	55	10887	120	23441
Other countries	782	140293	555	95884

Table – 27 : Imports of Titanium oxides (Other than Titanium Dioxides) (By Countries)

Country	2013-14		2014-15(P)	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	**570**	**80321**	**1604**	**204765**
China	474	46980	1286	117171
Japan	12	10331	24	10847
Germany	23	7328	165	41185
Italy	20	4546	40	8989
Saudi Arabia	20	3794	60	10084
USA	10	2925	19	3534
Singapore	11	2482	9	10097
France	++	1167	++	1226
Poland	++	277	++	764
UK	++	83	1	637
Other countries	++	408	++	231

FUTURE OUTLOOK

The major chunk of consumption of ilmenite is for the manufacture of synthetic rutile. The future demand of ilmenite during the 12th Plan Period at the GDP growth rate of 8%, 9% and 10% is estimated at 3.19 lakh, 3.27 lakh and 3.35 lakh tonnes, respectively, as per the Report of Working Group on Mineral Exploration and Development (other than coal & lignite) for the 12th Five Year Plan (2012-17), Planning Commission of India.

Demand for rutile for the next five years is projected at 44,000 to 45,000 tpy as per the GDP growth rate of 8- 10% the production estimates are 30,000 tpy as per the Working Group.

The Working Group has observed that no substantial progress in exploration activities for Beach Minerals was witnessed during the 11th Plan and has stressed on the need to take substantive steps to develop beach sand reserves of the country to its full potential by adopting suitable exploration strategy with modern techniques.

Global demand growth for TiO_2 is expected to trend with the prospects of economic growth and production of paint, paper and plastics.

Aerospace, defence and industrial uses are expected to strongly influence the consumption of titanium metal in the near future.