46 Ilmenite & Rutile

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 found associated with ilmenite. India is endowed with large resources of heavy minerals which occur mainly along coastal stretches of the country and also in inland placers. Ilmenite is the major constituent of these heavy-mineral deposits. Other associated minerals are rutile, zircon, monazite, leucoxene, garnet, sillimanite, etc.

RESOURCES

Ilmenite and rutile along with other heavy minerals form ingredients of beach sand deposits found right from Ratnagiri coast in the west to Odisha coast in the east. These minerals are concentrated in four 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 Valliyar river to Colachal, Manavalakurichi and little beyond in Kanyakumari district, Tamil Nadu (known as MK deposit).
* On Chatrapur coast stretching for 18 km between Rushikulya river mouth and Gopalpur light house 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 Bhabunia villages with an average width of 1.91 km in Puri district, Odisha.

The AMD of the Department of Atomic Energy has been carrying out exploration of these mineral deposits. So far, about 2,972 km coastal tract and 56.92 sq km along streams in the island areas of Namakkal and Trichy districts, Tamil Nadu have been investigated for over six decades by AMD. The ilmenite resource estimation for the areas explored up to 2006 has been almost completed and the resources are up from 461.37 million tonnes to 520.38 million tonnes (including leucoxene), inclusive of indicated, inferred and speculative categories. Resource estimation for the areas explored during 2006 to 2010 is under progress. The most significant deposits which are readily available and attract attention of industry for large-scale operations are as follows:

State/Deposit	Ilmenite reserve (In million tonnes)
Andhra Pradesh	
1. Amalapuram	15.57
2. Bhavanapadu Hukumpet	10.18
3. Kakinada (Phase I-VII)	29.62
4. Kalingapatnam	7.63
5. Narasapur	2.92
6. Nizampatnam	19.26
7. Srikurman	14.18
8. Visakhapatnam	3.60
Kerala	
1. Chavara	13.00
2. Chavara Eastern Extension	17.00
3. Chavara (Phase II)	49.00
Maharashtra	
Ratnagiri	3.04
Odisha	
1. Brahmagiri	61.10
2. Chatrapur	26.72
Tamil Nadu	
1. Kudiraimozhi	23.00
2. Navaladi-Periatalai	24.00
3. Sattankulam	14.48

Source: *Department of Atomic Energy, Mumbai.*

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 given in Table - 1.

As per the UNFC, total resources of titaniferous magnetite in the country as on 1.4.2005 are estimated at 40.68 million tonnes of which 1.29 million tonnes are placed under 'reserves' category and bulk i.e. 39.39 million tonnes under 'remaining resources' category. In addition, about 3.35 million tonnes resources of anatase are estimated in Meghalaya.

Table – 1 : Resources of Ilmenite and Rutile

(In million tonnes)

State	Total in situ #
Ilmenite* : Total	**520.38**
Andhra Pradesh	171.04
Bihar	0.73
Kerala	117.52
Maharashtra	3.74
Odisha	108.23
Tamil Nadu	117.07
West Bengal	2.05
Rutile : Total	**29.11**
Andhra Pradesh	10.30
Bihar	0.01
Kerala	7.24
Odisha	6.06
Tamil Nadu	5.31
West Bengal	0.19

Source: *Department of Atomic Energy, Mumbai.*
 # Inclusive of indicated, inferred and speculative categories.
** Including leucoxene.*

EXPLORATION & DEVELOPMENT

GSI carried out sea bed mapping and placer mineral investigations within the territorial waters of India in 2009-10. The surveys within Territorial Waters (TW) for placer mineral resource evaluation or sea bed mapping comprised Ganga Delta; off Bhimunipatnam, Andhra Pradesh; and off Paravur, Kollam district, Kerala.

Directorate of Geology, Odisha continued investigation taken up during 2009 for heavy minerals (ilmenite, rutile, zircon, garnet, monazite, etc.) in Nabha, Northeast sector along Puri Coast. Mapping over 1.9 sq km area on 1:2,000 scale was conducted along with 3,328 m auger drilling and collection of same number of samples during the year. Heavy mineral investigations were also taken up during 2009 in areas 3 to 6 km northeast of Puri town as also southwest of Konark around Tikina village along Puri Coast. About 5.2 sq km and 7.95 sq km tracts were mapped on 1:2,000 scale in the said areas with 2,013 m and 3,045 m auger drilling, respectively, covering 253 and 402 boreholes. Resources in the above areas are to be assessed.

The survey and exploration carried out by AMD during 2007-08, 2008-09 and 2009-10 included parts of Odisha, Andhra Pradesh, Tamil Nadu, Kerala, Gujarat and Maharashtra. The details of exploration activities carried out by AMD during 2009-10 are furnished in Table-2.

PRODUCTION AND PRICES

Ilmenite

The production of ilmenite at about 767 thousand tonnes in 2009-10 rose by 13.5% as compared to the preceding year. Tamil Nadu was the leading producer of ilmenite during the year contributing 55% of the total production followed by Odisha 27% and Kerala 18%. The value of production of ilmenite was Rs. 208.03 crore compared to Rs. 164.83 crore in 2008-09.

Table – 2 : Exploration Activities by AMD for Ilmenite, Rutile, Monazite, Zircon and other Heavy Minerals, 2009-10

Location	Activity: Reconnaissance survey (sq km)	Activity: Detailed survey (sq km)	Results
Parts of Gujarat, Odisha, Kerala, Maharashtra and Tamil Nadu	172 (Coastal tracts)	–	Reconanissance survey was undertaken to delineate potential heavy mineral concentrations along the coastal tracts: (a) Machiwada and Onjal in Tapi-Par river in Valsad and Navasari districts, Gujarat. Heavy mineral concentration of 12% was recorded. (b) Nechanpur and Bagda in Nunia and Panchpara nadi, Balasore district, Odisha. Heavy mineral concentration up to 20% was recorded. (c) Nileswaram and Chandragiri river mouth, Kasargod district, Kerala. Heavy mineral concentration of 8-10% in some zones up to 3 m depth from surface was recorded along 21 km long coast. (d) Bordi and Dahanu Coast, Thane district, Maharashtra. (e) Lacustrine sediments of down streams and plains of Kollimalai-Pachamalai hills of Tamil Nadu was recorded 20-50% heavy mineral concentration predominantly with garnet. A total of 56.92 sq km area was covered for stream sediment sampling under reconnaissance survey in the State.

Source*: Department of Atomic Energy, Mumbai.*

Rutile

The production of rutile at 18,575 tonnes in 2009-10 dropped by 4.7% as compared to that in the previous year. Odisha was the leading producer of rutile accounting for 43% of the total production followed by Kerala 36% and Tamil Nadu 21%. The value of production of rutile during 2009-10 was Rs. 76.13 crore as against Rs. 71.61 crore during the preceding year.

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

Table – 3 : Production of Ilmenite and Rutile 2007-08 to 2009-10 (By States)

(In tonnes)

State	2007-08	2008-09	2009-10
ILMENITE*			
India : Total	**675967**	**676003**	**767355**
Kerala	163141	128913	133832
Odisha	200845	200256	208781
Tamil Nadu	311981	346834	424742
RUTILE **			
India : Total	**20518**	**19498**	**18575**
Kerala	8230	6549	6608
Odisha	6976	7629	8034
Tamil Nadu	5312	5320	3933

** Includes production of V.V.Mineral and Beach Minerals Co.*
*** Includes production of V.V.Mineral.*
Source: *Department of Atomic Energy, Mumbai and IREL.*

Table – 5 : Prices of Rutile 2007-08 to 2009-10

(Rs. per tonne)

Year	Grade	Price	Remarks
IREL			
2007-08	Q/MK/OR	31000	Ex-works, bagged
(w.e.f. 1.10.2007)	Q/MK/OR	34000	Ex-works, bagged
(w.e.f. 20.11.2007)	Q/MK/OR	30000	Ex-works, bagged
(w.e.f. 8.2.2008)	Q/MK/OR	28000	Ex-works, bagged
2008-09	Q/MK/OR	28000	Ex-works, bagged
(w.e.f. 29.5.2008)	Q/MK/OR	30000	Ex-works, bagged
(w.e.f. 1.7.2008)	Q/MK/OR	32000	Ex-works, bagged
(w.e.f. 1.9.2008)	Q/MK/OR	34000	Ex-works, bagged
(w.e.f. 15.11.2008)	Q/MK/OR	37000	Ex-works, bagged
2009-10	Q/MK/OR	37000	Ex-works, bagged
(w.e.f. 7.4.2009)	Q/MK/OR	41000	Ex-works, bagged
KMML			
2007-08	94.85% TiO_2	28722	–
2008-09	94.85% TiO_2	31007	–
2009-10	94.85% TiO_2	44500 to 50000	–
V.V. Mineral			
2007-08	NA	23000	–
2008-09	NA	26613	–
2009-10	NA	34475	–

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

Table – 4 : Prices of Ilmenite 2007-08 to 2009-10

(Rs. per tonne)

Period	Grade	Price	Remarks
IREL			
w.e.f. 6.6.2006	Q	3750	Ex-works, bagged
	Q	3425	Naked at works
	MK	3525	Ex-works, bagged
	MK	3200	Naked at works
	OR	3200	Ex-works, bagged
	OR	2875	Naked at works
w.e.f. 19.11.2007	Q	4100	Ex-works, bagged
	Q	3775	Naked at works
	MK	3875	Ex-works, bagged
	MK	3550	Naked at works
	OR	3225	Naked at works
w.e.f. 1.9.2008	Q	4500	Ex-works, bagged
	Q	4175	Naked at works
	MK	4275	Ex-works, bagged
	MK	3950	Naked at works
	OR	3625	Naked at works
w.e.f. 9.1.2009	Q	4625	Naked at works
w.e.f. 14.2.2009	Q	5100	Ex-works, bagged
	Q	4700	Naked at works
	MK	4450	Naked at works
w.e.f. 7.4..2009	Q	5100	Ex-works, bagged
	MK	4450	Naked at works
	OR	5000	Naked at works
KMML			
2007-08	59.88% TiO_2	3289	–
2008-09	59.88% TiO_2	3427	–
2009-10	NA	NA	–
V.V. Mineral			
2007-08	Not specified	2950	–
2008-09	Not specified	2905	–
2009-10	Not specified	3009	–
BMC			
2007-08	TiO_2 : 48-50%	4700 (US$100)	f.o.b.Tuticorin
	TiO_2 : >51%	5640 (US$120)	
2008-09	TiO_2 : 48-50%	4700 (US$100)	f.o.b.Tuticorin
	TiO_2 : >51%	5640 (US$120)	
2009-10	TiO_2 : 48-50%	4050 (US$90)	f.o.b.Tuticorin
	TiO_2 : >51%	4950 (US$110)	

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, Tuticorin (Tamil Nadu) and M/s Beach Minerals Co. Pvt. Ltd, Kuttam (Tamil Nadu). IREL is exploiting beach sand deposits located at Chavara in Kerala, Gopalpur in Odisha and Manavalakurichi in Tamil Nadu.

At IREL, Chavara, beach washings are inadequate to meet the full requirement of the plant. The unit, therefore, 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 richest in TiO_2 content (75.8% TiO_2) and has great demand in India and abroad for manufacture of pigments.

At Manavalakurichi, deposit is spread over 300 hectares at Thuthoor-Ezudesam villages, Vilavancode tehsil, Kanyakumari district, Tamil Nadu. All the raw sand required to operate the separation plant at its full capacity is collected from nearby beaches by the fishermen of surrounding villages and supplied to the unit at cost. 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 Ganjam district extend along the coast of Bay of Bengal with an average width of 1.4 km and average depth of 7.5m. 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 today is finding its way in the international market as feed stock for production of both slag 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. Dry mining is very simple and economic as well . However, it is facing opposition by local people on the ground that removal of sand causes sea erosion. Therefore, collection of beach washings has reduced significantly in recent past.

As an alternate approach, IREL has adoptped 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 to Mineral Separation Plant in tippers. The Mineral Separation Unit Project of KMML is nearing completion and is under trial runs.

The mineral separation plants use variety of equipment such as gravity concentrators, high tension 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 weakly 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 has plans to expand MSP capacity at OSCOM to produce 5 lakh tonnes of ilmenite and associated minerals by the end of 2012. The Chavara Phase I expansion is to be completed to enhance the plant output to 200,000 tpy ilmenite. Trimex Group is understood to be gearing up to begin its 200,000 tpy ilmenite and 6,000 tpy 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, 2007-08 to 2009-10

(In tonnes)

Company/ Location	Mineral	Specification	Installed capacity (tpy)	Production		
				2007-08	2008-09	2009-10
Indian Rare Earths Ltd						
Manavalakurichi,	Ilmenite	55% TiO_2(min)	90000	89355	69681	55542
Kanyakumari dist.,	Rutile	94% TiO_2(min)	4000	3577	2368	1833
Tamil Nadu	Zircon	65% ZrO_2+HfO_2(min)	10000	8404	5813	4527
	Sillimanite	58% Al_2O_3	–	410	270	67
	Monazite	96% pure	6000	–	–	–
	Garnet	97% pure(min)	8500	14724	14527	13358
Chavara,	Ilmenite	58% TiO_2(min)	154000	113916	86403	89532
Kollam dist.,	Rutile	95% TiO_2(min)	10000	5233	3859	3273
Kerala.	Zircon	65% ZrO_2+HfO_2(min)	12000	12396	7772	8124
	Rare Earths	–	4500*	35**	22**	16**
	Sillimanite	58% Al_2O_3(min)	10000	14572	10443	7935
	Leucoxene	–	–	170	198	138
	Zirflor	(-)45 micron	6000	6619	1686	4183
	Microzir	(1-3 micron)	500	–	–	–
Orissa Sands Complex,	Ilmenite	50.25% TiO_2(min)	220000	200845	200256	208781
Ganjam dist., Odisha.	Rutile	94.25% TiO_2(min)	10000	6976	7629	8034
	Zircon	64.25% ZrO_2+HfO_2(min)	5000	5476	5807	5906
	Sillimanite	56% Al_2O_3(min)	10000	11609	13878	14117
	Garnet	94% garnet (min)	24000	11632	11455	11080
Kerala Minerals & Metals Ltd						
Chavara,	Ilmenite	59.88% TiO_2	51600	49225	42510	44300
Kollam dist.,	Rutile	93.20-94.85% TiO_2	3400	2997	2690	3335
Kerala	Zircon	64.81% ZrO_2	2500	2175	2445	2592
	Leucoxene	NA	300	–	–	–
	Monazite	NA	240	–	–	–
V.V. Mineral						
Tuticorin,	Ilmenite	51.5-52.5% TiO_2	450000	165541	215221	316200
Tamil Nadu.	Rutile	95% TiO_2(min)	(Total Heavy	1735	2952	2100
	Zircon	66% ZrO_2+HfO_2(min)	Minerals)	7526	7321	6900@
Beach Minerals Co. Pvt. Ltd						
Kuttam,	Ilmenite	KU grade 49-51% TiO_2	150000	57085	61932	53000
Tirunelveli dist.,						
Tamil Nadu.						

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

** In terms of rare earths chloride.*

*** Mainly Rare Earths Fluoride, Cerium Oxide and Cerium Hydrate from conversion of Rare Earths Chloride.*

@ Besides, 7,900 tonnes production of zircon-sillimanite is also reported.

INDUSTRY

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 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 199,7 as it was economically not viable.

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 tonnes of TiO_2 in a phased manner is under implementation. The capacity augmentation of synthetic rutile plant was expected to be commissioned by November 2010. The company also has plans to enhance pigment capacity to 60,000 tpy for which detailed project report is under preparation. The company had developed in 2009 Nano Titanium Dioxide particles on laboratory scale and in July 2011, India's first comercial plant for synthesis of nano-titanium dioxide was commissioned.

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 presses is marketed as Utox. The company has plans to increase the capacity of plant to 36,000 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 24000 tpy & 72000 tpy, rspectively.

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 proposals to expand its capacity to 27,000 tpy, modernise and diversify in stages 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 Tuticorin districts in southern Tamil Nadu.

The 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 has only facility of pilot plant. M/s V. V. Mineral has plans to set up a 5 lakh tpy titanium pigments 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 DMRL technology and first batch of titanium was delivered in September 2011. It will be further expanded to 1,000 tpy. Titanium sponge is imported by Midhani for further processing in the country. 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 OSCOM ilmenite at 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.

The available data on plantwise capacities & production of synthetic rutile and TiO_2 pigement from 2007-08 to 2009-10 are given in Table-7. However, domestic production of synthetic rutile and TiO_2 pigment is estimated at 100,000 tpy and 60,000 tpy, respectively.

Table – 7 : Installed Capacity and Production of Synthetic Rutile/Titanium Dioxide Pigement, 2007-08 to 2009-10

(In tonnes)

Plant	Location	Specification	Installed capacity (tpy)	Production		
				2007-08	2008-09	2009-10
Total			**237000** (Synthetic rutile)	**70594**	**62169**	**70584**
			77000 (TiO_2 Pigment)	**59973**	**54145**	**63641**
IREL	Orissa Sands Complex, Dist. Ganjam, Odisha.	90.5% TiO_2 (minimum)	100000 (Synthetic rutile)	–	–	–
KMML	Chavara, Kerala	92%-93% TiO_2	50000 (Synthetic rutile)	NA	NA	NA
			40000 (TiO_2-Chloride Process)	35221	35486	35908
DCW Ltd	Sahupuram, Dist. Tuticorin, Tamil Nadu	95% TiO_2	42000 (Synthetic rutile)	37934	27566	36384
CMRL	Edayar Industrial Dev. Area Kochi, Kerala	96.5% TiO_2	45000 (Synthetic rutile)	32660	34603	34200
TTPL	Thiruvananthapuram, Kerala	97.5% TiO_2	22000 (TiO_2-Sulphate Process)	12607	7731	15273
Kilburn * Chemicals	Thoothukudi, Tamil Nadu	98% TiO_2 (min)	12000(e) (TiO_2-Sulphate Process)	12145	10928	12460
Kolmak Chemical Ltd	Kolkata, West Bengal	NA	3000(e) (TiO_2-Sulphate Process)	NA	NA	NA

Source: Department of Atomic Energy, Mumbai and individual companies.
Note: *KMML captively consumes synthetic rutile while CMRL and DCW export synthetic rutile.*
** Data relates to calendar year.*

USES

Ilmenite is used mainly for the manufacture of ferro-titanium and synthetic rutile; i.e., titanium dioxide, a white pigment. Because of a unique combination of its superior properties of high refractive index, low specific gravity, high hiding power and opacity and non-toxicity, titanium dioxide finds application for 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 cosmetic products, etc. Because of its non toxic nature, it is used in cosmetics, pharmaceuticals, and even added to foodstuffs as well as in toothpastes to improve their brightness. 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 reported ilmenite consumption rose to 268,183 tonnes in 2009-10 as compared to 237,579 tonnes in 2008-09. Bulk ilmenite was consumed for manufacturing of synthetic rutile (83%), followed by pigment industry (14%). Remaining 3% consumption was by steel plants, ferro-alloys and welding electrode manufacturers. The reported consumption of rutile in 2009-10 declined to 13,088 tonnes from 18,980 tonnes in 2008-09. Bulk consumption was in electrode industry. In 2009-10, the reported consumption of ferro-titanium was 968 tonnes. About 77% consumption was in iron and steel industry and 23% in alloy steel and foundry industries (Table - 8).

Table – 8 : Consumption of Ilmenite, Rutile and Ferro-Titanium, 2007-08 to 2009-10 (By Industries)

(In tonnes)

Industry	2007-08	2008-09	2009-10
ILMENITE*			
All Industries	**284357(R)**	**237579(R)**	**268183(P)**
Synthetic rutile**	218213	186518	221715
Pigment (TiO_2)	57408	42831	37898
Others (steel plants, ferro-alloys and welding electrode)	8736	8230	8570
RUTILE* **			
All Industries	**15957**	**18980(R)**	**13088(P)**
FERRO-TITANIUM@			
All Industries	**924(R)**	**1286(R)**	**968(P)**
Alloy steel & foundry	216	246	222
Iron & steel	708	1040	746

Source: *Department of Atomic Energy, Mumbai (for ilmenite & rutile).*

* *Relates to sales figures of IREL and KMML except for synthetic rutile industry.*

** *Relates to consumption reported by three units to Department of Atomic Energy and estimates for one unit based on reported production.*

*** *Relates to sales figures of IREL and KMML along with captive consumption in pigment unit.*

@ *Reported consumption data collected on non-statutory basis by IBM.*

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 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 which hitherto was 74%, has recently been raised to 100 percent.

Joint ventures with foreign participation are 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 are 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 export and import, 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 feed stocks because it affects the marketability of beach sand ilmenite. Titanium alloys may be replaced in aerospace applications by lithium-aluminium alloys or carbon-epoxy composites.

WORLD REVIEW

The world reserves of ilmenite are estimated at 680 million tonnes in terms of TiO_2 content. Major reserves are in China (29%), Australia (19%), India (13%), South Africa (9%), Madagascar and Brazil (6% each), Norway (5%) and Mozambique (2%). The world reserves of rutile are 45 million tonnes in terms of TiO_2 content. Major rutile rserves are located in Australia (49%), followed by South Africa (18%) and India (16%). Australian mineral sands deposits hold the world's largest resources of the titanium-bearing minerals rutile and ilmenite, as also zircon, the zirconium-bearing mineral.

World production of ilmenite and rutile concentrates was 10 million and 0.6 million tonnes, respectively, in 2009. Canada contributed 20% of ilmenite production, followed by Australia and South Africa with 14% each. Australia produced 46% of world rutile output, followed by South Africa with 22% and Ukraine 16%. World resources 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) : 725000		
World : Total (Rounded)	**680000**	**45000**
Australia	130000	22000
Brazil	43000	1200
Canada	31000	–
China	200000	–
India*	85000	7400
Madagascar	40000	–
Mozambique	16000	480
Siera Leone	–	2800
Norway	37000	–
South Africa	63000	8300
Ukraine	5900	2500
USA	6000	400
Vietnam	1600	–
Other countries	26000	400

***Source**: Mineral Commodity Summaries, 2010.*

***** *As per Department of Atomic Energy, Mumbai, the total resources of ilmenite in India are estimated at about 520 million tonnes and rutile at 29 million tonnes.*

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

(In '000 tonnes)

Country	2007	2008	2009
World: Total (wt. of concs)	**11446**	**11105**	**10000**
All form of TiO_2 (e)	**6100**	**5900**	**5300**
Australia Ilmenite	2339	2060	1449
Leucoxene	164	126	165
Canada e#@	2500	2600	2000
China (e)	1260	1080	900
India*	679	600 e	650 e
Norway	882	915	671
South Africa #	1402	1360	1445 e
Ukraine (e)	600	600	600
USA (e)	400	300	300
Other countries	1220	1464	1820

***Source**: World Mineral Production, 2005-2009.*

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

***** *As per Department of Atomic Energy, Mumbai, India's production of ilmenite in 2007-08, 2008-09 and 2009-10 was 675,967tonnes, 676,003 tonnes and 767,355 tonnes, respectively.*

*Processed into slag. In 2009, South Africa produced an estimated 1,850 thousand tonnes (85% TiO_2) and Canada produced 800 thousand tonnes (80-95% TiO_2).*

@ *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	2007	2008	2009
World: Total (wt. of concs)	**645**	**667**	**615**
Australia	312	318	281
India*	20	21 e	21 e
South Africa (e)	111	132	134
Ukraine (e)	100	100	100
Other countries	102	96	79

***Source:** World Mineral Production, 2005-2009.*

***** *As per Department of Atomic Energy, Mumbai, India's production of rutile in 2007-08, 2008-09 and 2009-10 was 20,518 tonnes, 19,498 tonnes, and 18,575 tonnes, respectively.*

Titanium Metal

More than half of the world's titanium sponge production capacity is located in the CIS. The main sources of growth in demand have been the industrial applications, aerospace industry and military applications. Companies have been increasing output of titanium sponge from existing facilities as well as adding new production capacity.

Synthetic Rutile

The titanium dioxide pigment accounts for more than 90% world consumption of titanium minerals. It is the brightest among white pigments and main applications are in paints, paper and plastics. North America and Europe account for more than half the world demand of this pigment.

Australia

Jacinth-Ambrosia mine of Iluka in Eucla Basin, South Australia began production. The mine is expected to have a life span of 10 years and will produce a total of 1.5 million tonnes ilmenite, 350,000 tonnes rutile and 2.8 million tonnes zircon. The company was also upgrading its mineral separation plant at Narngulu to treat the concentrates from the new mine.

China

China's titanium metal and pigment capacity was continuing to rise. Five leading sponge producers have raised the capacity from 44,000 tpy in 2008 to 63,000 tpy in 2009.

Japan

Toho Titanium Co. was going ahead increasing its sponge cpacity to 28,000 tpy with a new 12,000 tpy sponge plant at Wakamatsu, Fukuoka.

Russia

Lukoyanovskoye heavy mineral sands deposit of ARMZ Uraniumm Holding Co. was under development. The mine would have a 1.5 million tpy ore sands procuring plant by 2014.

FOREIGN TRADE

Exports

Exports of titanium ores & conc. rose to 464,947 tonnes in 2009-10 as compared to 226,306 tonnes in the preceding year. Exports in 2009-10 were almost entirely of ilmenite 463,625 tonnes. Besides, rutile 382 tonnes and other titanium ores 940 tonnes were also exported. Main destinations were China (54%), Netherlands (22%), Japan (12%) and Rep. of Korea (8%).

Exports of titanium and alloys (including waste & scrap) were 90 tonnes in 2009-10 as compared to 60 tonnes in the previous year. Exports were mainly to Rep. of Korea, Saudi Arabia and Canada. Exports of tiatinum oxide and dioxide (total) decreased to 28,145 tonnes in 2009-10 from 33,643 tonnes in 2008-09. Out of total exports in 2009-10, those of titanium dioxide were 5,941 tonnes and other titanium oxides were 22,201 tonnes . Exports were mainly to Singapore (38%), Japan (31%), USA (8%) and China (5%) (Tables - 12 to 19).

Imports

Imports of titanium ores & conc. rose sharply to 32,104 tonnes in 2009-10 as compared to 11,071 tonnes in the preceding year. Out of total imports of titanium ores & conc. in 2009-10, those of ilmenite were 11,137 tonnes, rutile 15,239 tonnes and other titanium ores were 5,728 tonnes. Main suppliers were Australia (31%), Mozambique (26%), Sri Lanka (16%) and Ukraine (11%).

Imports of titanium and alloys (including waste & scrap) were 1,745 tonnes in 2009-10 as compared to 809 tonnes in the previous year. Imports were mainly from Japan, USA, France, China and Russia. Imports of titatinum oxide and dioxide (total) were 15,453 tonnes in 2009-10 as compared to 15,707 tonnes in the preceding year. Out of these, imports of titanium dioxide were 15,174 tonnes and those of other oxides were 279 tonnes in 2009-10. Imports were mainly from USA (18%), Germany (15%), Rep. of Korea (14%) and China (12%) (Tables - 20 to 27).

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**226306**	**1872050**	**464947**	**2526109**
China	23865	129588	249174	940460
Japan	54991	1029688	56767	852670
Netherlands	75104	311033	102424	407606
Singapore	1800	57129	4120	123037
Korea, Rep of	22785	105680	34980	121309
Poland	–	–	12500	57744
Germany	1	10	4900	19849
Iran	400	11263	26	786
Malaysia	45144	208448	–	–
Spain	1225	5803	–	–
Other countries	991	13408	56	2648

Source: *DGCI & S, Kolkata.*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**224884**	**1841826**	**463625**	**2506478**
China	23665	123841	248156	932434
Japan	54949	1028887	56725	851783
Netherlands	75104	311033	102424	407606
Singapore	1800	57129	4120	123037
Korea, Rep. of	22785	105680	34800	114018
Poland	–	–	12500	57744
Germany	1	10	4900	19849
Algeria	168	1256	–	–
Malaysia	45137	207974	–	–
Spain	1225	5803	–	–
Other countries	50	213	++	7

Source : *DGCI & S, Kolkata.*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**933**	**24100**	**382**	**14399**
Korea, Rep. of	–	–	180	7291
China	200	5747	100	4096
Bangladesh	40	1114	20	827
Iran	300	8394	26	786
Japan	42	705	42	780
Kenya	–	–	7	301
Indonesia	41	1582	1	48
Malaysia	7	474	–	-
Philippines	200	5227	–	–
Turkey	100	641		–
Other countries	3	216	6	270

Source : *DGCI & S, Kolkata..*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**489**	**6124**	**940**	**5232**
China	–	–	918	3930
UAE	–	–	22	1195
Japan	++	96	++	107
Bulgaria	304	2939	–	–
Iran	100	2869	–	–
Nepal	++	14	–	–
Thailand	85	206	–	–

Source : *DGCI & S, Kolkata.*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**60**	**236491**	**90**	**382639**
Saudi Arabia	9	61980	14	107220
Canada	++	78	14	85101
Korea, Rep. of	2	13617	29	55716
Norway	1	11293	3	37677
Singapore	4	13346	4	22024
Qatar	1	11251	4	16264
Germany	2	2209	8	12784
UAE	3	9288	4	9525
UK	12	34332	1	6527
Malaysia	4	11757	2	6149
Other countries	22	67340	7	23652

Source : *DGCI & S, Kolkata.*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**33643**	**1537613**	**28142**	**1330398**
Japan	10832	358446	8649	352356
Singapore	10270	349539	10700	317665
USA	1261	78443	2245	157760
Italy	728	71595	952	99070
Iran	817	70387	662	69876
Thailand	280	20634	867	66133
Spain	714	65653	517	53012
Malaysia	958	75742	736	44237
China	4974	208931	1281	39754
Korea, Rep. of	349	36434	116	7029
Other countries	2460	201809	1417	123506

Source : *DGCI & S, Kolkata.*

Table – 18: Exports of Titanium Dioxide By Countries)

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**6833**	**616091**	**5941**	**579449**
Japan	248	24011	1058	103341
USA	495	43816	1243	92881
Italy	728	71595	844	87174
Iran	817	70387	662	69876
Spain	714	65653	517	53012
Singapore	780	67933	300	28831
UAE	132	12165	169	22530
Netherlands	240	22083	75	14662
Korea, Rep. of	331	31561	90	6052
China	741	64403	40	4286
Other countries	1607	142484	943	96804

Source : *DGCI & S, Kolkata.*

Table – 19 : Exports of Titanium Oxides (Other than Titanium Dioxides) (By Countries)

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**26810**	**921522**	**22201**	**750949**
Singapore	9490	281606	10400	288834
Japan	10584	334435	7591	249015
USA	766	34627	1002	64879
Thailand	260	18660	592	38635
Malaysia	918	72026	624	36140
China	4233	144528	1241	35468
Italy	–	–	108	11896
Nigeria	80	2487	142	4185
Australia	120	8594	60	3770
UAE	85	6293	6	388
Other countries	274	18266	435	17739

Source : *DGCI & S, Kolkata.*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**11071**	**283881**	**32104**	**747639**
Australia	3032	98771	9918	331457
Ukraine	797	26939	3564	131377
Sri Lanka	5110	92839	4999	81947
Thailand	126	4624	1775	54474
Mozambique	–	–	8505	44581
South Africa	767	26953	1166	39217
Vietnam	825	22125	970	27959
Sierra Leone	-	-	558	20811
Malaysia	217	5073	488	10803
UAE	110	2890	75	2173
Other countries	87	3667	86	2840

Source : *DGCI & S, Kolkata.*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**1492**	**6725**	**11137**	**68649**
Mozambique	–	–	8505	44581
Thailand	–	–	324	10092
Sri Lanka	1432	4576	2080	7560
Australia	–	–	162	4617
Malaysia	5	36	42	1009
South Africa	–	–	24	790
Germany	++	3	–	–
Indonesia	25	394	–	–
UK	30	1716	–	–

Source : *DGCI & S, Kolkata.*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**6592**	**210186**	**15239**	**527866**
Australia	2742	91273	7747	264707
Ukraine	737	24638	3160	117681
Sri Lanka	1880	55067	1436	52157
South Africa	599	21154	828	28852
Sierra Leone	–	–	558	20811
Vietnam	275	7816	645	18811
Thailand	126	4624	405	13351
Malaysia	151	3429	374	8657
Austria	–	–	40	1540
Indonesia	22	712	46	1299
Other countries	60	1473	–	–

Source : *DGCI & S, Kolkata.*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**2987**	**66970**	**5728**	**151124**
Australia	290	7498	2009	62133
Thailand	–	–	1046	31031
Sri Lanka	1798	33196	1483	22230
Ukraine	60	2301	404	13696
South Africa	168	5799	314	9575
Vietnam	550	14309	325	9148
UAE	50	1417	75	2173
Malaysia	61	1608	72	1137
UK	10	842	–	–
Other countries	–	–	++	1

Source : *DGCI & S, Kolkata.*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	**809**	**1323628**	**1745**	**3069414**
Japan	9	13615	665	1385705
USA	282	215603	473	524725
France	29	78285	209	509963
China	133	167182	158	195326
Russia	109	322348	118	167780
Italy	47	109928	30	96012
UK	50	68440	35	74550
Korea, Rep. of	25	60123	11	30963
Germany	11	30553	12	25557
Luxembourg	21	82652	–	–
Other countries	93	174899	34	58833

Source : *DGCI & S, Kolkata.*

Table – 25 : Imports of Titanium & Alloys (Incl. Waste) (By Countries)

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	**15707**	**1469923**	**15453**	**1691888**
Germany	1808	244389	2361	335215
USA	1930	209263	2812	323937
Korea, Rep. of	1964	198153	2237	222724
China	3822	220525	1918	147842
Czech Republic	436	42753	1339	143129
Japan	1112	110676	600	90157
Australia	479	47069	645	70849
Malaysia	738	73929	642	66809
Chinese Taipei/Taiwan	724	76764	522	58000
Singapore	357	38265	501	56049
Other countries	2337	208137	1876	177177

Source : *DGCI & S, Kolkata.*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	**14090**	**1379447**	**15174**	**1656308**
Germany	1666	225397	2289	323630
USA	1929	209085	2771	318532
Korea, Rep. of	1963	197912	2237	222647
China	2472	158305	1917	143888
Czech Republic	436	42753	1339	143129
Japan	1093	108958	596	85506
Australia	479	47069	645	70849
Malaysia	738	73880	642	66809
Chinese Taipei/Taiwan	724	76764	522	58000
Singapore	357	38265	500	54770
Other countries	2233	201059	1716	168548

Source : *DGCI & S, Kolkata.*

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	**1617**	**90476**	**279**	**35580**
Germany	142	18992	72	11585
USA	1	178	41	5405
Italy	80	3264	120	4918
Japan	19	1718	4	4651
China	1350	62220	1	3954
Ukraine	20	2219	40	3625
Singapore	–	–	1	1279
Korea, Rep. of	1	241	++	77
UK	1	105	++	37
France	2	1287	–	–
Other countries	1	252	++	49

Source : *DGCI & S, Kolkata..*

FUTURE OUTLOOK

The world demand of titanium dioxide is recovering slowly. The feedstock markets (viz, ilmenite, rutile, titanium slag, etc.) are in deficit supply. Global TiO_2 pigment consumption is on the rise in countries like USA and China. New capacities are adding up through expansion/ restoration. Worldover, preference was for high TiO_2 chloride feedstock and for sulphate markets, preference was for ilmenite over slag.

Indian heavy-mineral resources (for titanium) are one of the largest in the world. Moreover, ilmenite of higher grades is available in the world in large quantities. With the steady industrial growth in the country, domestic titania sector is also expected to grow suitably.