

# 76 Tungsten

**T**ungsten is a vital metal of strategic importance in times of war. The chief sources of tungsten are minerals scheelite ( $\text{CaWO}_4$ ) and wolframite  $[(\text{Fe},\text{Mn})\text{WO}_4]$  which are deposited by hydrothermal solutions. Tungsten has a melting point of  $3,350^\circ\text{C}$ , the highest of all metals and it is resistant to all acids at ordinary temperatures. It is elastic, ductile and has high tensile strength and can be drawn into very thin wires. The domestic requirements of tungsten and its products are met through imports.

## RESOURCES

The total resources of tungsten ore in the country, as per UNFC system, as on 1.4.2005 have been estimated at 87.4 million tonnes containing 142,094 tonnes  $\text{WO}_3$  content. All these resources are placed under 'remaining resources' category.

Resources are mainly distributed in Karnataka (42%), Rajasthan (27%), Andhra Pradesh (17%) and Maharashtra (9%). Remaining 5% resources are in Haryana, Tamil Nadu, Uttarakhand and West Bengal (Table - 1).

At Degana, Rajasthan,  $\text{WO}_3$  value in vein deposits varies from 0.25 to 0.54% while in gravel deposit, it is, on an average 0.04%. In Sirohi deposit, Rajasthan,  $\text{WO}_3$  content ranges from 0.02 to 2.2%. In West Bengal, Bankura deposit contains, on an average, 0.1%  $\text{WO}_3$ . In Kuhl-Khobana-Agargaon belt, GSI has identified seven mineralised zones in Sakoli basin in Bhandara and Nagpur districts, Maharashtra. The analysis showed 0.01 to 0.19%  $\text{WO}_3$  in Kuhl block, 0.13 to 0.38%  $\text{WO}_3$  in Khobana block and 0.48%  $\text{WO}_3$  in Pardi-Dahegaon-Pipalgaon block. The deposit contains 0.17%  $\text{WO}_3$  on an average. Gold ore at Mysore mine of BGML in Karnataka has been reckoned as a potential source of scheelite. The tailing dumps at Kolar Gold Fields contain about 0.035 to 0.18%  $\text{WO}_3$ .

## PRODUCTION & PRICES

There was no production of tungsten ore/concentrate during 2007-08. The production of tungsten was reported from Degana, Rajasthan and Chendapathar, West Bengal in the past. The domestic prices of tungsten ore and concentrate are given in Table - 2.

**Table - 2 : Prices of Tungsten Ore and Conc. 2005-06 to 2007-08**

(In Rs/tonne)			
Market	2005-06	2006-07	2007-08(p)
Average c.i.f. price, Indian ports	183.125	10.45	9.20

## MINING & PROCESSING

Vein deposits of wolframite occurring in Degana and Chendapathar are found associated with quartz veins, the width of which varies from a few centimetres to three metres or sometimes even more. In Degana, Rajasthan, it is also associated with gravel beds overlain by 2.5 m thick sand.

Gravel mining was carried out in the past in selected areas where wolframite was found to be concentrated. The overburden sand was loosened and loaded manually and transported by tractor unit at dump sites. The payable gravel was then worked.

In case of vein deposits, ore body was cut with chisel and hammer at convenient places forming undercuts. At Degana, Rajasthan, tungsten ore body occurs in vein, stockwork and alluvial deposits. Inclined veins were developed by putting adits in the stockwork.

Degana in Rajasthan and Chendapathar in West Bengal were the only operative mines of tungsten in India producing meagre quantities of concentrate. But because of economic non-viability, they have since closed down.

TUNGSTEN

**Table - 1 : Reserves/Resources of Tungsten as on 1.4.2005  
(By Grades/States)**

Grade/State	Reserve Total (A)	Remaining resources							Total resources (A+B)
		Feasibility STD211	Pre-feasibility STD222	Measured STD331	Indicated STD332	Inferred STD333	Reconnaissance STD334	Total B	
<b>All India : Total</b>									
Ore	-	2230000	173063	19784073	23435954	25183128	16581246	87387464	87387464
Contained WO <sub>3</sub>	-	3568	450	10056	20180.92	103273.15	4566.28	142094.35	142094.35
<b>By States</b>									
<b>Andhra Pradesh</b>									
Ore	-	-	-	3640000	4700800	5952500	509000	14802300	14802300
Contained WO <sub>3</sub>	-	-	-	5096	6574.64	8273.65	318.28	20262.57	20262.57
<b>Haryana</b>									
Ore	-	2230000	-	-	-	-	-	2230000	2230000
Contained WO <sub>3</sub>	-	3568	-	-	-	-	-	3568	3568
<b>Karnataka</b>									
Ore	-	-	-	15534073	11805499	-	9338246	36677818	36677818
Contained WO <sub>3</sub>	-	-	-	3057	1775	-	1403	6235	6235
<b>Maharashtra</b>									
Ore	-	-	-	610000	5637250	1830000	-	8077250	8077250
Contained WO <sub>3</sub>	-	-	-	1903	10304	3828	-	16035	16035
<b>Rajasthan</b>									
Ore	-	-	-	-	963666	17000628	5964000	23928294	23928294
Contained WO <sub>3</sub>	-	-	-	-	1421.44	90171.5	2115	93707.94	93707.94
<b>Tamil Nadu</b>									
Ore	-	-	-	-	-	-	250000	250000	250000
Contained WO <sub>3</sub>	-	-	-	-	-	-	50	50	50
<b>Uttarakhand</b>									
Ore	-	-	-	-	138000	-	520000	658000	658000
Contained WO <sub>3</sub>	-	-	-	-	25	-	680	705	705
<b>West Bengal</b>									
Ore	-	-	173063	-	190739	400000	-	763802	763802
Contained WO <sub>3</sub>	-	-	450	-	80.84	1000	-	1530.84	1530.84

## TUNGSTEN

### USES

The main use of tungsten is in the form of ferro-tungsten in the making of special and alloy steels. Ferro-tungsten typically contains between 25% and 75% tungsten. The other principal use of tungsten is in the manufacture of tungsten carbide, one of the hardest synthetic materials used in industry. It is used widely in cutting and wear-resistant materials, particularly those that have to work at high temperatures. Tungsten wires form the filament in incandescent light bulbs and cathodes for electronic tubes. The metal is used in superalloys with copper or silver and in chemical industry. It is also used in armour plate and armour-piercing ordnance. Tungsten compounds are used in dyes and pigments, manufacture of paints and printing ink and also in ceramic industry for producing yellow tint.

### SUBSTITUTES

Titanium, tantalum and niobium carbides can be used in some wear-resistant applications. Molybdenum tool steels and tungsten tool steels are interchangeable. In some cutting tool applications, bulk ceramic is an alternative. Tungsten remained the essentially unsubstitutable material for filaments, electrodes, and contacts in lamp & lighting applications. However, an electrodeless, non-tungsten lamp is available for commercial and industrial uses.

### TECHNICAL POSSIBILITIES

Further development of new metal shaping method; i.e., laser is possible. Development of new cutting tool materials could reduce the usage. Increased use in ceramics and in catalysts is possible because of increasing use of coating on cemented carbide cutting tools to prolong tool life. Use of tungsten scrap could be increased. Tungsten compounds could be used in light-sensitive applications.

### POLICY

As per the Foreign Trade Policy, 2004-09, the imports and exports of tungsten ores and concentrates can be made freely.

### CONSUMPTION

The entire domestic requirements of tungsten ore/concentrates are met by imports. Sandvik Asia Ltd, Pune; Widia (India) Ltd, Bangalore; Indian Hard Metal Pvt. Ltd, Kolkata; and Rapicut Carbides Ltd, Ankaleshwar, Gujarat are the important consumers of tungsten ores and concentrates for mining machinery. Mishra Dhatu Nigam Ltd, Hyderabad and Sunflag Iron & Steel Co. Ltd, Bhandara, Maharashtra, were the important consumers of ferro-tungsten for alloy steel. Consumption of tungsten ore/concentrate and ferro-tungsten during 2005-06 to 2007-08 is given in Tables - 3 and 4, respectively.

**Table - 3 : Reported Consumption\* of Tungsten Ore/Conc. 2005-06 to 2007-08**

(In tonnes)

Industry	2005-06	2006-2007	2007-08(p)
<b>All Industries</b>	<b>500</b>	<b>500</b>	<b>500</b>
Mining machinery	500 (5)	500 (5)	500 (5)

*Figures rounded off.*

*Data collected on non-statutory basis.*

*Figures in parentheses denote the number of units in organised sector reporting consumption.*

*\* excluding defence requirements.*

**Table - 4 : Reported Consumption of Ferro-tungsten, 2005-06 to 2007-08**

(In tonnes)

Industry	2005-06	2006-07	2007-08(p)
<b>All Industries</b>	<b>50</b>	<b>50</b>	<b>50</b>
Alloy steel	50 (5)	50 (5)	50 (5)

*Figures rounded off. Data collected on non-statutory basis. Figures in parentheses denote the number of units in organised sector reporting consumption.*

### WORLD REVIEW

The world reserve base of tungsten in terms of metal content is 6.3 million tonnes, distributed broadly amongst China (67%), Canada (8%), Russia (7%) and USA (3%) (Table -5).

The world production of tungsten in terms of metal content in 2007 decreased slightly to 56,800 tonnes from 58,700 tonnes in 2006. China was the leading producer (72%), followed by Russia (8%) and Canada (5%) (Table-6).

## TUNGSTEN

China was the world's largest producer and exporter of tungsten. Its policy of not granting mining permits so as to control output, and maintaining export quotas to control exports continued. However, mine output continued to rise. The issue of mining licences was provisionally halted in 2005.

**Table - 5 : World Resources of Tungsten  
(By Principal Countries)**

(In '000 tonnes of metal content)

Country	Reserve base
<b>World : Total</b>	<b>6300</b>
Austria	15
Bolivia	100
Canada	490
China	4200
Korea, North	35
Portugal	62
Russia	420
USA	200
Other countries	740

*Source: Mineral Commodity Summaries, 2008.*

## FOREIGN TRADE

### Exports

In 2007-08, exports of tungsten ores and concentrates decreased to 133 tonnes as against 415 tonnes in the previous year. Exports were mainly to China. Exports of tungsten, alloys and scrap decreased to 113 tonnes in 2007-08 from 273 tonnes in the previous year. Exports were mainly to USA (27%), Sweden (18%), UAE (14%), and France (4%) (Tables - 7 and 8).

### Imports

Imports of tungsten ores and concentrates decreased to 20 tonnes in 2007-08 from 149 tonnes in the previous year. Imports in 2007-08 were from Israel. Imports of tungsten and alloys including scrap decreased to 293 tonnes in 2007-08 from 326 tonnes in the previous year. Imports were mainly from China (41%), Germany (22%), USA (9%) and Rep. of Korea (8%) (Tables - 9 to 11).

**Table - 6 : World Mine Production of Tungsten  
(By Principal Countries)**

(In tonnes of metal content)

Country	2005	2006	2007
<b>World : Total</b>	<b>61900</b>	<b>58700</b>	<b>56800</b>
Austria	1280	1153	1117
Bolivia	530	870	1106
Canada	484	2561	2700
China	51200	45000	41000 <sup>(e)</sup>
Korea, Dem. People's Rep. of <sup>(e)</sup>	600	600	600
Portugal*	816	780	846
Russia* <sup>(e)</sup>	4400	4000	4400
Thailand*	622	546	823
Uzbekistan <sup>(e)</sup>	300 <sup>(e)</sup>	300 <sup>(e)</sup>	300 <sup>(e)</sup>
Other countries	1668	2890	3908

\* Wolframite & Scheelite.

*Source: World Mineral Production, 2003-2007.*

TUNGSTEN

**Table - 7 : Exports of Tungsten Ores & Conc.  
(By Countries)**

Country	2006-07		2007-08	
	Qty. (t)	Value (Rs. '000)	Qty. (t)	Value (Rs. '000)
<b>All Countries</b>	<b>415</b>	<b>11452</b>	<b>133</b>	<b>2805</b>
China	-	-	130	2784
Nepal	-	-	3	21
Turkey	400	4137	-	-
UK	15	7315	-	-

**Table - 8 : Exports of Tungsten and Alloys  
Incl. Scrap  
(By Countries)**

Country	2006-07		2007-08	
	Qty. (kg)	Value (Rs. '000)	Qty. (kg)	Value (Rs. '000)
<b>All Countries</b>	<b>272735</b>	<b>495396</b>	<b>113583</b>	<b>318028</b>
Sweden	40005	48749	20410	54950
USA	40047	61750	30793	50894
UAE	44392	19833	15489	17503
France	5077	27692	4541	16785
Iran	3328	27098	1952	16299
Germany	3781	24043	1207	13189
Ukraine	10316	41040	2124	12799
Egypt	2716	24934	1171	11770
Poland	10953	33996	2411	10911
Singapore	6824	38077	1053	6535
Other countries	105296	148184	32432	106393

**Table - 9 : Imports of Tungsten Ores & Conc.  
(By Countries)**

Country	2006-07		2007-08	
	Qty. (t)	Value (Rs. '000)	Qty. (t)	Value (Rs. '000)
<b>All Countries</b>	<b>149</b>	<b>1557</b>	<b>20</b>	<b>184</b>
Israel	149	1557	20	184

TUNGSTEN

**Table - 10 : Imports of Tungsten & Alloys Incl. Scrap  
(By Countries)**

Country	2006-07		2007-08	
	Qty. (kg)	Value (Rs. '000)	Qty. (kg)	Value (Rs. '000)
<b>All Countries</b>	<b>325599</b>	<b>674363</b>	<b>292983</b>	<b>652703</b>
China	137476	276503	120693	249947
Germany	94905	169731	64662	160633
Japan	11088	31980	13218	49455
Korea, Rep. of	31856	67552	22630	47518
Sweden	300	956	15837	35225
USA	14342	33233	26643	34929
Singapore	14120	30684	9588	18581
Austria	2333	8891	2940	11598
Chinese Taipei/Taiwan	2146	6424	3417	9109
France	3865	10067	2782	7135
Other countries	13168	38342	10573	28573

**Table - 11 : Imports of Tungsten  
(By Items)**

Item	2006-07		2007-08	
	Qty. (kg)	Value (Rs. '000)	Qty. (kg)	Value (Rs. '000)
<b>All Items</b>	<b>325599</b>	<b>674363</b>	<b>292983</b>	<b>652703</b>
Tungsten & alloys, unwrought	198547	332825	170883	341739
Tungsten filament	2005	14760	3306	20336
Tungsten wire	111619	306230	100253	259405
Tungsten, unwrought	10428	18904	18541	31223
Tungsten scrap	3000	1644	-	-

## FUTURE OUTLOOK

World tungsten supply will continue to be dominated by Chinese production and

exports. In India, the entire demand can only be met by imports as there is no indigenous production of tungsten concentrates.