INTERNATIONAL MOLYBDENUM ASSOCIATION
THE VOICE OF THE MOLYBDENUM INDUSTRY

Molybdenum scrap saves resources

A recent study found that about one quarter of the molybdenum used each year is recycled material from scrap sources. The rest is newly mined, primary molybdenum. Scrap therefore plays an important role in meeting demand and contributing to sustainability.

Like most metals, molybdenum is fully recyclable. This is one of the key sustainability benefits of metals.

Recycling of scrap for the production of new materials requires less energy than the production of primary metal and it causes fewer emissions. It is also often sourced locally, so transport routes are short. For the steel producer, scrap is the most economical material to add to the melt. Because recycling is so important, IMOA wanted to know more about how much molybdenum is recycled and where. The market research company SMR therefore carried out a study on the scrap market for molybdenum.

Molybdenum comes from two sources: mining and recycling. In 2011, almost 80,000 tonnes or about 25% of all moly used was recycled, making scrap an important part of the molybdenum supply chain.

Steel and metal alloy scrap – the source of recycled molybdenum

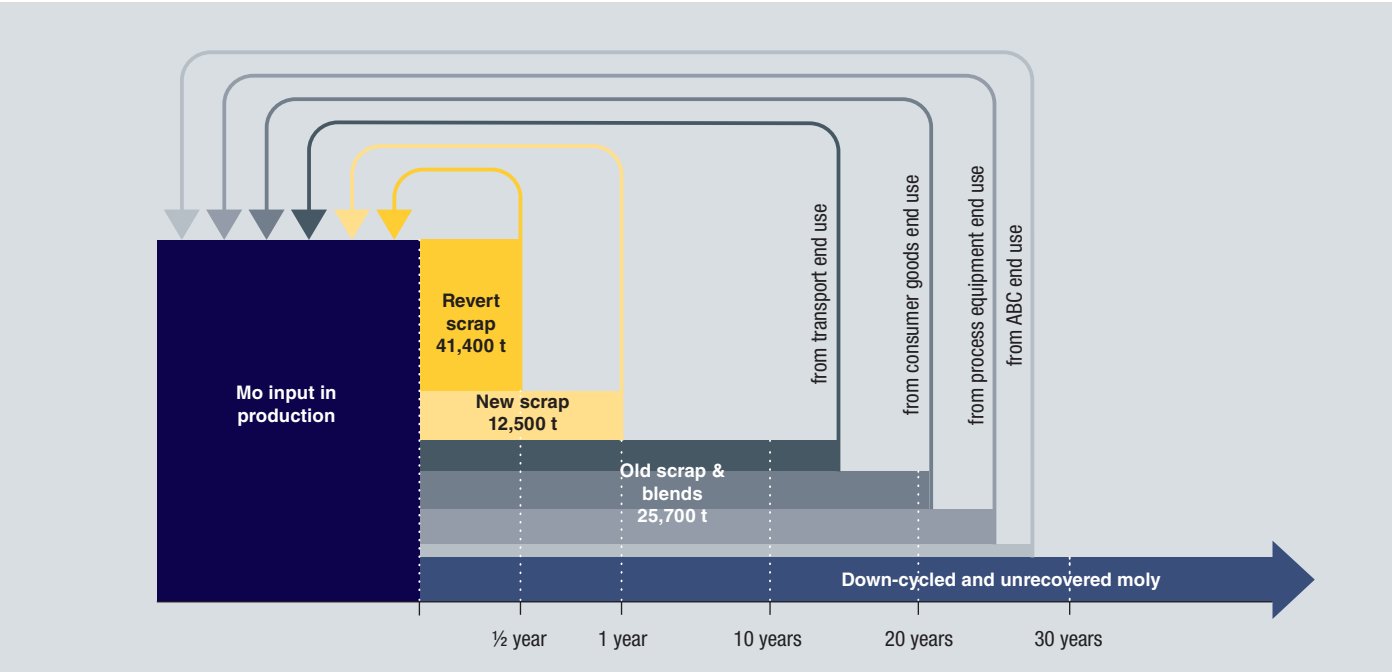
By far the largest use of molybdenum is as an alloying element in steels. It is therefore mostly recycled in the form of steel scrap. Molybdenum 'units' are returned to the furnace where they are melted together with primary molybdenum and other raw materials to make steel. There are four major categories of scrap:

Revert scrap – remnants produced in the steelmaking process like cut-off ends or edge trimmings. This scrap is usually returned to the furnace and re-melted quickly after its generation.

New (or first use) scrap – remnants generated by the steel mill customers – the service centers and fabricators of the steel. This scrap returns mainly via scrap collectors and processors, mostly within half a year after production in the steel mill.

Old (or end use) scrap – steel products at the end of their useful life – for example old washing machines or cars. This scrap is collected by scrap dealers. The age of old scrap ranges widely, between five years for some consumer goods to over 50 years for building products and process equipment. The average is around 25 to 30 years.

Blends – Mo units that come from a different scrap source than the product for which it is intended. For example, ›



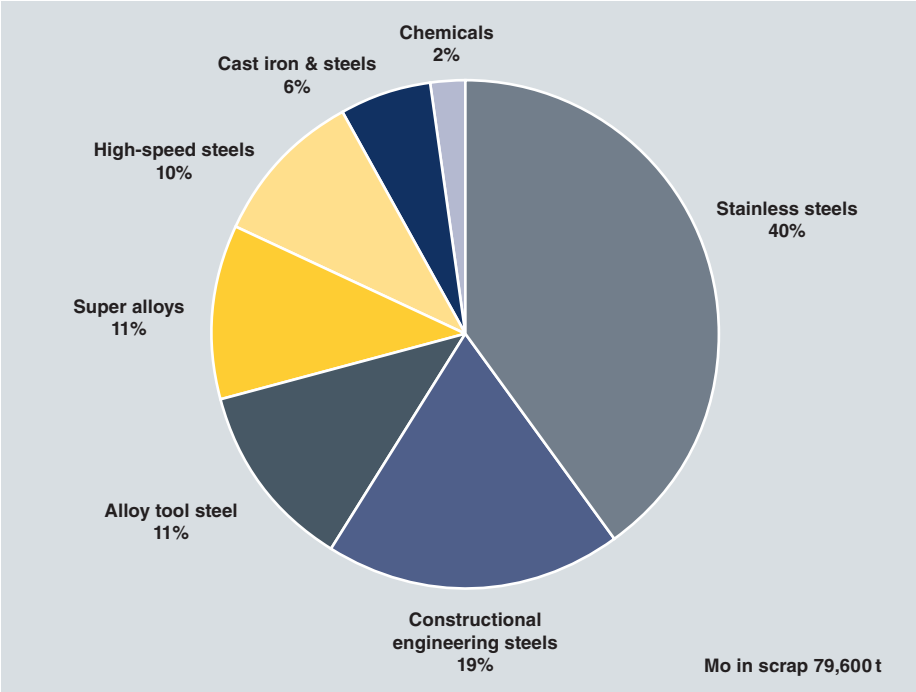
The molybdenum scrap reuse cycle for 2011. Of the 25% total scrap input 13% was revert scrap and 4% each new scrap, old scrap and blends.

a blend intended for the production of Type 316 stainless steel may contain molybdenum from nickel-based alloy scrap. Blending is a core competence of the major scrap processors. They use sophisticated programs to create scrap blends, tailored to the specifications of a particular customer. Treated spent refinery catalysts are also sometimes used in blends for stainless steel, nickel alloys and special alloy engineering steels due to their high moly content of over 60%.

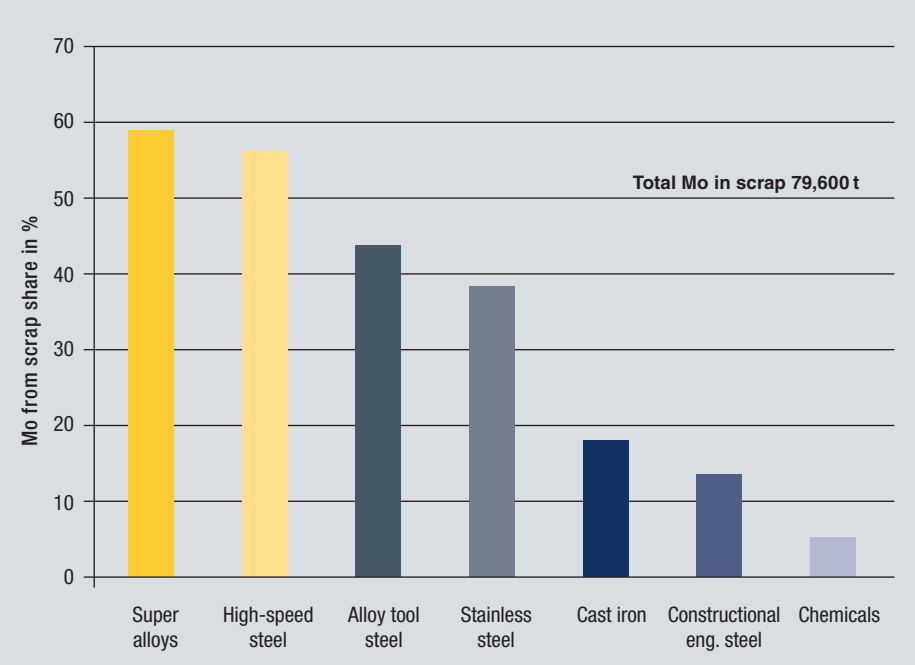
Major markets using moly scrap

About 60% of Mo scrap is used to produce stainless and constructional engineering steels. The remainder is used to produce alloy tool steel, super alloys, high-speed steel, cast irons and chemicals.

Stainless steels – A producer of Mo-containing stainless steel could use molybdenum almost entirely from scrap, if sufficient scrap were available. However, the popular Type 316 stainless steel is produced using, on average, only about 38% Mo units from scrap. The balance comes from new primary Mo. The main reason for the limited availability of Mo-containing stainless steel scrap is the continuing increase in demand for these grades. Their superior corrosion resistance, and therefore their longer service life, could be a contributing factor. Some 40% of all molybdenum recycled in scrap is used for stainless steel production.



The proportion of scrap reused varies by product segments.



Molybdenum from scrap as a percentage of total Mo input.

Alloy steels – The production of alloy steels uses around 19% of all molybdenum containing scrap. Most of this is revert scrap from within the steel mill. Because engineering steels generally contain less than 0.5% Mo, the incentives for its collection are relatively low. Engineering steels are recycled, but usually not for their molybdenum content. The molybdenum is therefore 'down-cycled' into general steel production, where it may or may not have a material value. Hence, primary molybdenum is the main source of Mo units for engineering steel.

Tool steels and super alloys – Scrap is very important for the high-speed tool steel and nickel-based super alloy industries – where over 50% of Mo input comes from scrap. Most of it is revert scrap, due to the significant amount of scrap generated in the production process. This in-house recycling is crucial for cost control of these expensive alloys. High-speed tool steel and super alloy new and old scrap are valuable due to their high Mo content. They are also often used in blends for other steels. However, these first uses are relatively small for both Mo scrap and primary Mo. ›

Molybdenum-containing stainless steels like these Type 316 solar water heaters are diligently collected at their end-of-life due to their high value. © Centro Inox

Trends in scrap usage

The near future – The ratio of recycled molybdenum to primary molybdenum used in moly-containing products has fallen in recent years. Molybdenum from scrap represented 25% of the total usage in 2011, compared to 27% in 2000, chiefly because the rapid growth of demand for molybdenum in this period outpaced the availability of scrap. Nowhere has this been more evident than in China: The domestic market is too young to generate significant volumes of stainless steel scrap, while production of moly-containing steels has flourished. The use of recycled molybdenum in the developing markets is expected to readjust to more typical levels in the future when end-of-life scrap becomes available in larger quantities.

Stainless steel scrap is a raw material for new stainless steel. © Cronimet

The longer term – The use of molybdenum from scrap is expected to grow to about 110,000 tonnes by 2020, representing a return to about 27% of all moly use. By that time, scrap availability in China will increase to over 35,000 tonnes annually. Today, Europe is still the region with the highest first use of moly scrap with about 30,000 tonnes per year. Unlike China, Europe's use of scrap is expected to stay at more or less the same proportion of the total until 2020.

By 2020, approximately 55,000 tonnes annually of Mo units worldwide will originate from revert scrap; about 22,000 tonnes from old scrap and the remainder will be split between blend material and first use scrap. By 2030, Mo from scrap is expected to reach 35% of all Mo used, a result of further maturing of the economies of China, India and other developing countries and an increasing emphasis on separating and recycling valuable streams of material.

IMOA members can order the full SMR report from the secretariat. (Markus Moll)