

Article no. 1: METEC 2015

Metal smelting: indispensable and innovative Shorter development cycles – a challenge for the industry

METEC 2015 – the International Metallurgical Trade Fair with congresses will be presenting innovative solutions for smelting, rolling and steel mills.

We depend on metals in practically all areas of life. The term is derived from the ancient Greek word μέταλλον (métallon, quarry) and stands for certain chemical elements. Their atoms form a lattice with free moving electrons that is characteristic in each individual case. The typical properties of metals, such as electrical conductivity, heat conductivity, ductility (formability) and metallic lustre, are based on this structure. With a few exceptions, metals only occur in nature in the form of ores, in which they are bonded with non-metallic substances. The metal content is separated, processed and formed into raw material (“smelted”) by metallurgical processes. This raw material then comes onto the market as a semi-finished product for further processing. The word “metallurgy”, which also comes from ancient Greek, essentially means “smelting technology”. The processes chosen depend on the metal. While copper and iron ore was already smelted at an early stage of the history of mankind with the help of higher temperatures that were produced by burning charcoal, titanium – for example – was not produced industrially until the end of the 1930s.

Metals are divided up into ferrous and non-ferrous metals. The former include iron, steel and cast iron, while the latter include copper, aluminium, titanium and alloys of them, i.e. combinations with at least one other metal. The choice of a metal for specific applications depends on the properties and the production costs. The automotive industry is an excellent example of the use of metals. According to the brochure “Chemie am Auto” published in 2014 by Wirtschaftsgesellschaft des KfZ-Gewerbes, steel and other ferrous



The Bright World of Metals

**Düsseldorf, Germany
16 - 20 June 2015**

**9. Internationale Metallurgie-
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9th International Metallurgical
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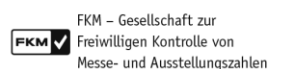
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materials account for more than 60% of the total weight of a motor vehicle; non-ferrous metals (such as copper, zinc and lead) account for 2%, while 8% are attributable to lightweight metals (aluminium and magnesium) and special metals like gold (in electronic systems) and platinum (in catalytic converters) contribute 0.2%. Plastics account for the second-largest proportion of the weight (about 19%).

The following article highlights some of the special technical features of ferrous and non-ferrous metals, the processing of the feedstock materials and the production of crude metals as well as the refining and shaping of them into semi-finished products that are ready for use. The companies in the metallurgical industry – smelting, rolling and steel mills – face tremendous competitive pressure; they do, however, have a number of technical options that enable them to reduce operating costs while increasing manufacturing strengths. METEC 2015, the central trade fair for metallurgy and smelting technology, which is taking place in Düsseldorf from 16. to 20. June 2015, will be giving an insight into current and future developments.

Traditional – in tune with the times - innovative

The end of the 18th century and, above all, the 19th century, which are known as the “industrial age”, were characterised by numerous discoveries and inventions that influenced each other and contributed to the industrialisation process. Thanks to new developments in smelting technology, it became possible to manufacture steel in large quantities. After centuries in which it had been produced laboriously by manual methods, steel now became a key material thanks to its outstanding mechanical properties. With steel, it was possible to build structures like the Eiffel Tower in Paris, railway stations, railway lines, locomotives and other rolling stock as well as machines that harness energy. The large-scale generation of electricity that became feasible in the second half of the century stimulated further developments. Due to its excellent electrical conductivity, copper played an increasingly prominent role in power transmission and helped – among other things



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– to enable the aluminium ore bauxite to be smelted and aluminium to be exploited industrially.

Ferrous materials – more than 3,500 different types of steel

Steel is defined as iron and carbon alloys with a carbon content of between 0.01 and 2.06 per cent, which – in contrast to cast iron – can be processed by forming. Depending on the temperature and carbon content, the iron atoms form two different types of lattice – body or face centred cubic. The consequence of this special feature is that the technological properties of steel can be varied to a very large extent by heat treatment processes and the addition of alloying elements. According to the World Steel Association, there are in the meantime more than 3,500 different types of steel, so that it would be correct to say that steel is by far the most used metal material. An original model of the basic iron cell (in the body centred cubic configuration) can be seen in the Belgian capital: the “Atomium”, the Brussels landmark, is a basic cell magnified 165 billion times; the balls – eight at the corners and one in the middle of a cube – represent the iron atoms.

Steel is manufactured in two stages. First of all, iron ore is smelted into raw steel in a blast furnace. Global raw steel production amounted to 1.6 billion tonnes in 2013. The molten raw steel and steel scrap are then refined into steel in converters or electric arc furnaces, where the alloying process is also carried out. Steel that is needed in large quantities is given its final form via continuous casting followed by hot rolling while the steel is solidifying. Semi-finished products like strip, rods, profiles or tubes are manufactured in this way.

Non-ferrous metals

Non-ferrous metals are all metals except for iron, including alloys in which no iron is present or iron is not the main metal. Light metals are a sub-division of non-ferrous metals. Copper and aluminium are in widespread use. Copper has very good electricity and heat conductivity properties, while it also has favourable mechanical properties, is easily processed and resists corrosion very well. About 60% of copper production is used in energy technology and telecommunications



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engineering. Copper is, however, also a very important material in electrical installation. In contrast to other metals, aluminium is less dense – a feature it combines with good mechanical properties and high corrosion resistance as well as high electrical and thermal conductivity. Typical application areas are aircraft manufacturing and – to an increasing extent – car manufacturing. The physical properties of copper, aluminium and other metals can be changed to a very large extent by alloying processes.

Innovation pressure and trends

The requirements made on metal products are growing all the time. Since their properties depend substantially on the composition and structure of the semi-finished feedstock, the demands of the metallurgical industry are increasing too. Companies work constantly on optimisation of their processes and materials. Close co-operation with the downstream companies in a production chain, such as foundries or wire manufacturers, as well as with research institutes and within trade associations has therefore become increasingly important and helps everyone involved to remain competitive. The metallurgical industry has to come to terms with growing innovation pressure combined with shorter and shorter innovation cycles, while it is also forced to reduce operating costs – one way to do which is to make efficient use of raw materials and energy. Environmental factors need to be taken into consideration to an increasing extent too. Electronic systems have become indispensable in order to be able to monitor and control processes but also to simulate casting, cooling and forming operations and optimise them on this basis. Close attention has to be paid to temperature control in casting and production with dimensions as near to the final requirements as possible. Sensible use of energy also means taking advantage of the heat that is generated in many processes. This is done either in-house or by passing the heat on to neighbouring industrial operations for it to be used there.



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The METEC 2015 trade fair

Smelting companies need innovative machines, equipment, software systems and much more besides in order to be able to operate efficiently. The International Metallurgical Trade Fair METEC, which is being held at the same time as the trade fairs GIFA, THERMPROCESS and NEWCAST that focus on associated fields and all share the same motto (The Bright World of Metals), will be providing information about this and the innovative developments that are being made. The exhibition programme includes machines and equipment for producing and processing raw and feedstock materials, for manufacturing pig iron and non-ferrous crude metal, for refining, casting and shaping steel and non-ferrous metals, for recycling and for many other purposes.

METEC 2015 will be taking place in Düsseldorf from 16. to 20. June 2015.

The Bright World of Metals:

The four international technology trade fairs GIFA (International Foundry Trade Fair), METEC (International Metallurgical Trade Fair), THERMPROCESS (International Trade Fair for Thermo Process Technology) and NEWCAST (International Trade Fair for Precision Castings) are being held in Düsseldorf from 16. to 20. June 2015. Visitors from all over the world will be coming to the city on the River Rhine for five days at this time to focus on castings, foundry technology, metallurgy and thermo process technology. A programme of high-quality additional events will again be taking place alongside the trade fairs, involving seminars, international congresses and lecture series. All four trade fairs and the programmes co-ordinated with them will be concentrating on the issue of resource optimisation and energy efficiency. A total of 79,000 experts from 83 different countries visited the stands of the 1,958 exhibitors at the previous events in 2011. Further information is available in the Internet at www.gifa.de, www.metec.de, www.thermprocess.de and www.newcast.de.

Messe Düsseldorf organises not only GIFA, METEC, THERMPROCESS and NEWCAST with the joint motto "The Bright World of Metals" but also other high-quality trade fairs for the metallurgical and foundry industries all over the world. They include FOND-EX (International Foundry Fair) and Stainless in the Czech Republic, Metallurgy India, Metallurgy-Litmash (International Trade Fair for Metallurgy Machinery, Plant Technology & Products) and Aluminium Non-Ferrous in Russia, indometal in Indonesia, metals middle east in Dubai, ITPS (International Thermprocess Summit) Americas and Asia and the Aluminium trade fairs in China, India, the United Arab Emirates and Brazil. The range of events held for the metal industries at the Düsseldorf location is rounded off by: Valve World Expo (International



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Trade Fair and Congress for Industrial Valves and Fittings) and ITPS Düsseldorf as well as the international trade fair ALUMINIUM organised by Reed Exhibitions and Composites Europe.

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Further information and photos are available at www.metec.de

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