Editorial

Humans have used, since the dawn of history, and processed sometimes, materials necessary to acquire food, improve their safety and ensure the relevant life level. Following the human civilisation history one may come to believe than its development is decided to a great extent by development of materials and the accompanying development of means of production. This is attested, undoubtedly, among others, by naming the various periods in the history of humankind by materials deciding at the time conditions of life, e.g., ages of stone, gold, bronze, iron. Some of them pertained to the nonferrous metals and their alloys. Also implementing of various inventions was made possible only after the relevant materials were available. The vision of the future, connected - of course - with forecasts pertaining to development of various areas of life and production processes, makes it possible to take into account that nearly all of the prognosticated undertakings call for using the relevant manufacturing technologies, and above all using the appropriate engineering materials.

Materials related issues play the important role in carrying out tasks of the engineering circles. Material is a substance from which products are made in which customers are interested; therefore, the most important issue is to design materials is such way that their structure and properties are formed so that they meet requirements of their service environment. All engineering materials have equal rights from the product design point of view, those that can ensure the required product properties and selection of the material with the best service and technological properties and the lowest possible material and product manufacturing, processing, and use costs is based on the multicriteria optimisation.

Multitude of materials available nowadays, including metals and their alloys, leads inevitably to the need of their proper selection for constructional or functional elements, tools and eventually other products or their elements. This selection should be made based on multicriterial optimisation. Nowadays, within the framework of the computer aided design- (CAD) and computer aided manufacturing systems (CAM) the due place is also taken by the computer aided materials selection systems (CAMS), and in case when employment of the quite new and unknown so far engineering materials is needed, which can be specified at the engineering design stage as the set of properties only, one has to use the continuously developing computer aided materials design systems (CAMD). Dissemination of these methods and the computer aided engineering tools is a domain of the continuously developing computational materials science. Various methodical approaches are employed to this end, including modelling using FEM systems (finite elements method) and similar ones, artificial intelligence methods – especially the neural networks, and lastly also the multiscale modelling. Computational materials science makes elimination possible to a greater extent of factors, and even subjective errors, and the selected materials have the most advantageous service and technological properties, at the appropriate density and lowest possible materials costs and products made from them.

More than 70 from all the chemical elements are metals. The yearly iron production, as one of them, and rather of steel and its other alloys, exceeds 1.25 Gt, whereas each of the other non-ferrous metals and their alloys are manufactured in a much smaller amount; however their high technical importance and significant number of brands used in engineering decide the complexity of this problem and its high significance. Metals occur in Earth crust in various portions. The highest amount is of aluminium (7.45%) in Earth's crust and iron is only the next one (5.6%). Magnesium takes the sixth place (2.09%), followed by titanium (0.42%). Copper takes next the seventeenth place (0.01%), nickel the eighteenth (0.0075%), and zinc the nineteenth only (0.007%). The total yearly consumption of metals in the world depends among others on the particular element's commonness in the Earth's crust, but also on its price and properties that can be obtained. Clearly, consumption of the non-ferrous metals is relatively low. Consumption of aluminium, ranked next after iron, is more than 40 times lower than of steel and is about 29.8 Mt yearly (according to data published for 2006 by US Geological Survey), consumption of copper, ranked next, is smaller nearly 90 times than of steel and is about 14.6 Mt, and of zinc, fourth on the list, it is lower even nearly 130 times than of steel and is 9.6 Mt. Those ranked next are Mn – 9.35 Mt, Cr – 5.38 Mt, Pb – 3.11 Mt, Ni – 1.39 Mt, Mg – 584 kt, Sn – 262 kt, Li – 254 kt, Mo – 141 kt, Sb – 113 kt, rare-earth elements RE – 101 kt, W – 73,7 kt, Co – 52,4 kt. The world Ti production is only 24.7 kt, Ag – 19.7 kt, Zr – 6.5 kt, Au – 2.43 kt, and of the platinum metals – 467 t. The world production of Hf is 45.4 t, and of Re – 36.7 t. Prices of the non-ferrous metals are very differentiated and the span between the most expensive caesium - 54 300 000 USD/t, and one of the cheapest: manganese – 1 090 USD/t is nearly 50 thousand times. Exemplary prices of platinum metals are 14 500 000 USD/t, Au – 13 200 000 USD/t, Re – 1 010 000 USD/t, Hf – 269 000 USD/t, Ag – 207 000 USD/t, Zr – 78 000 USD/t, Co – 43 400 USD/t, Nb – 19 700 USD/t , Ni – 13 800 USD/t, Ti – 11 000 USD/t, Mg – 3 470 USD/t, Cu – 2910 USD/t, Al. – 1 850 USD/t, and Zn – 1 160 USD/t.

Light metals and their alloys, including Al, Ti, Be, and Mg may be distinguished among the non-ferrous metals. Heavy metals include Cu, Zn, Pb, Ni, Co, Zr, Hf, Cd, In, and Bi as well as their alloys. Among the difficult melting materials and their alloys Nb, Ta, Mo, W, Re may be distinguished, and among the noble metals Au, Ag, Pt, Pd, Ir, Os, Ru, Rh and their alloys. Alkali metals and alkaline earth metals and the rare metals, including the rare-earth metals and actinides belong to the numerous other metals and alloys. Properties of the non-ferrous metals alloys may be formed with various technological methods, especially by heat treatment, thermo-mechanical and plastic treatment, and surface of products made from them or their elements may be formed using many surface engineering methods. The state-of-the-art materials of the contemporary engineering belong also to applications of the non-ferrous metals, including the non-ferrous metal materials conducting electric current and with special magnetic properties as well as the non-ferrous smart materials, including those with shape memory, sintered materials and fabricated with the powder metallurgy methods based on the non-ferrous metals and their alloys, alloys of the non-ferrous metals with the intermetallic phases composition, non-ferrous metals with low heat expansion, non-ferrous nanostructural metal materials and the non-ferrous metallic glasses and solid state amorphous metal materials, non-ferrous metal highly porous materials with metallic foams and Gasar metals, and also the non-ferrous composite materials, including among others the composite materials with foams and highly porous materials, and the non-ferrous biomedical and biomimetic materials and those used in the dental prosthetics.

Due to the diversified service properties the areas of the non-ferrous metals and their alloys applications are very wide, sometimes competitive to the iron alloys, and very often complementary for them, or they are even unrivalled. Moreover, one of the important employment criteria of the particular metals is their toxicity, carcinogenicity or radioactivity. Because of the ecological issues use of some metals and alloys which were rather commonly used so far is being abandoned in the last decades and especially in the last years. It is an undisputable imperative, when metals are harmful or their alloys and compounds which were in use in practice so far, but also employment is abandoned very often of materials whose manufacturing or processing technologies are encumbered with the excessive ecological hazard. Metals easily assimilated by human body are especially toxic, among others in the forms of vapours and easily soluble salts. Many metal elements are perilous due to their radioactivity. This, clearly, restricts their applications solely, in essence, to special tasks in which they are unrivalled so far.

Journal of Achievements in Materials and Manufacturing Engineering publishes many papers pertaining to various groups of the non-ferrous metals alloys, including the ecological aspects of their use. We are still looking forward to further proposals of the P.T.Authors in this area. We expect these contributions to be interesting for our P.T. Readers as usual.

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