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Welding of contemporary materials in thermal power plants. Global trend related to the increased demand for energy is followed by the development of contemporary materials and welding processes. Although there are different projections of future energy sources development (nuclear reactors, renewable energy sources, etc.), the European Commission estimates that the energy generated by combustion of different fuels in thermal power plants will be one of the most important sources for energy supply to households, industry, transport and other sectors. Such energy can be further used for production of electricity and heating, as well as for any other purpose. In addition to defined operating parameters set for materials used in thermal power plants, such as service temperature, pressure and extremely aggressive operating media in exploitation, there is also a demand for prolonged service life of such materials. While producing components for thermal power plants, joining of materials is unthinkable without modern welding processes. Since the welded joint is the weakest point in any welded product, the welding issues require special attention in all stages of components design, manufacture, maintenance and exploitation in thermal power plants. This paper elaborates welding process and pressure applied in welding of low-alloy and high-alloy steels, as well as of Ni-alloys that are used in manufacturing of thermal power plant components (T/P 23, T/P 24, T/P 91, T/P 92, etc.). Special emphasis is put on connection of scientific findings from the field of metallurgy and welding with the practical experiences, having in mind the constant necessity of achieving better quality and reliability of welded joints in components used in thermal power plants.

2. **R. Kawalla, M. Ullmann, M. Oswald, U. Prahl;** *BA-Technical University of Freiberg,Freiberg,Germany*
Developments in the field of semi – finished Mg products. Due to their advantageous strenght-weight ratio, good recyclability, excellent noise and vibration damping properties as well as excellent dent resistance, magnesium materials offer a variety of uses in modern lightweight structures. As a result, a comeback of magnesium alloys is to be seen in multiple industrial applications, especially in the automotive industry, as the potential for lightweight cost-sffective lightweight industrial construction associated with the lightest metallic engineering material helps to meet even stricter energy and environmental efficiency guidelines. Traditionally, casting processes (primarily die–casting) have been the dominant manufacturing processes, but in the last decade, an increasing number of lightweight structural applications have been implemented with magnesium wrought alloys. End-of-life requirements are steadily increasing seemingly inversely to price demands. The current state of developments in the field of the production of semi-finished products made of magnesium alloys and characterization will be presented here. A reduced number of stages in the manufacturing process of continuous casting for producing near-net-shape primary material sections with high performance forming process thus offers new possibilities for providing magnesium materials that meet current and future requirements for semi-finished products, construction and moldings in terms of type,quantity and quality. In addition to technology development of long and flat products as well as hybrid products, the associated material science and process engineering issues are fundamentally analyzed.Furthermore, the processing properties as well as the application potential of magnesium semi-finished products are described.

3. **A. Panda[1], J. Dobránsky[1], M. Jančík[2], I. Pandová[1], M. Kačalová[1];** *[1]Technical University of Košice, Faculty of Manufacturing Technologies with a seat in Prešov, Prešov, Slovak Republic, [2]SPINEA s.r.o., Prešov, Slovak Republic*
Advantages and effectiveness of the powder metallurgy in manufacturing technologies. Powder metallurgy is the manufacturing science of producing solid parts of desired geometry and material from powders. Although the process has existed for more than 100 years, over the past quarter century it has become widely recognized as a superior way of producing high-quality parts for a variety of important applications. This success is due to the advantages the process offers over other metal forming technologies, advantages in material utilization, shape complexity, near-net-shape dimensional control, among others. Commonly known as powder metallurgy, it may also be referred to as powder processing considering that non-metal powders can be involved. Powders are compacted into a certain geometry then heated, (sintered), to solidify the part.

4. **T. Vuherer[1], I. Samardžić[2], A. Stoić[3], D. Bajić[4];** *[1]Mechanical Engineering Faculty, University of Maribor, Slovenia; [2]IWE, Mechanical Engineering Faculty in Slavonski Brod, Josip Juraj Strossmayer University of Osijek, Croatia; [3]Mechanical Engineering Faculty in Slavonski Brod, Josip Juraj Strossmayer University of Osijek, Croatia; [4]Mechanical Engineering Faculty, University of Podgorica, Montenegro*
Challenges of application of high-strength steel in welded constructions. Application of high-strength steel enables reduction of welded constructions' weight. This is especially important in mobile and portable welded structures (e.g. pressure vessels, road and rail vehicles, cranes, bridges, etc.), where a smaller mass of exploited welded construction facilitates the reduction of energy consumption. Thanks to the greater strength of these steels, it is possible to realize larger bridges and long arms and levers at large cranes with a smaller construction mass. In addition to giving examples of practical applications of high-strength steels, this paper also discusses the welding problems of these steels. The results of welding the modern high-strength steels (S690QL, S960QL and S1100QL) and practical examples of welding technology are presented in the paper. The welding tests were carried out after the weld thermal cycle simulation on the Smitweld 1406 simulator and on real-welded samples. The obtained results of mechanical properties (hardness, strength, toughness...) and metallographic tests showed that welding of these high-strength steels was successful, however, it was extremely important to strictly monitor the prescribed welding technology, as even the smallest deviations could cause the weakening of at least one zone in the welded joint. There is a lack of experimental results referring to the weldability and practical experience in the application of these steels. Any contribution to the experience of using these high-strength steels shall be also a valuable contribution to the reliability of constructions made of these steels, as well as to the wider application of these steels in mechanical engineering constructions.

5. **I. E Uskova, N. L.Chekunova-Tomacheva;** *National University of Science and Technology "MISIS" (MISIS), Moscow, Russia*
Determination of performance criteria for mergers and acquisitions in the metals industry. The criteria for measuring the effectiveness of mergers and acquisitions may be: to maximize profits, reduce production costs, expansion of sales, increasing competitiveness. Performance criteria of mergers and acquisitions must meet the ultimate goal and to the nature of the joint stock company as the basic organizational - legal form of companies entering into a transaction to restructure the business. The Companies Act contains a provision that "society is created without any time limitation. This feature should be understood in the sense that, as it is not a temporary commercial organization and structure, functioning on a continuous basis, providing for the indefinite existence, which implies the need for continuous performance criterion. Such a condition is satisfied by the growth rate value of companies in mergers and acquisitions. Thus, the process of capitalization of metallurgical companies in mergers and acquisitions, confirms the thesis about a factor of increasing shareholder value as a strategic goal and performance criteria.

6. **Ivo Alfirević, Professor emeritus;** *University of Zagreb,Faculty of Mechanical Engineering and Naval Architecture, Zagreb, Croatia*
The historical highlights of plasticity and metal forming. The first scientifically relevant experiments in plasticity were performed by Charles A. de Coulomb 1784 in France and František Josef Gerstner 1831 in Prague. Particularly extensive and important experiments were made by Henri Édouard Tresca and presented to French Academy of Science in 1864. Tresca also formulated the first yield criterion called maximum shear stress criterion. On Trescas exprimental results Barré de Saint-Venant formulated the first plasticity theory in 1871 assuming that the volume of material does not change during plastic deformation and that the directions of principal strains coincide with directions of the principal stresses. This is known as total strain theory. He solved some practical problems such as the twisting of rods, bending of rectangular beams and pressurizing of hollow cylinders. M.T. Huber proposed in 1904. maximum distortion energy yield criterion. It was independently developed in 1913 by Richard von Mises and 1925 explained by Heinrich Hencky. St.Venant's student M.Lévy in his paper published in 1872 improved St.Venant's theory and assuming that the directions of plastic strain increments coincide with directions of the principal stresses. The same indepedently did von Mises and these constitutive equations are known as Lévy-Mises equations. They do not contain elastic part of strain. Prandtl introduced elastic strains in constitutive equations in 1924 for plain strain problems and Reuss in Budapest in 1930 extended it to 3D problems. These constitutive equations are known as Prandtl -Reuss equations. Prandtl solved problem of rigid identor in 1921 and Nadai of rigid wedge the same year using slip lines. Hencky developed slip line theory in 1923. Hilda Geiniger in 1930 first clearly formulated the velocity equations. The slip line theory was succesfully applied for solution in metal forming problems such as rolling, deep drawung, extrusion etc.