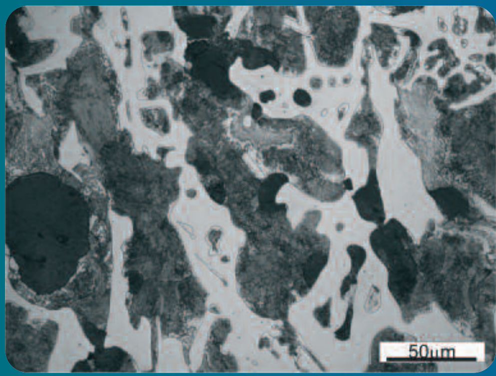
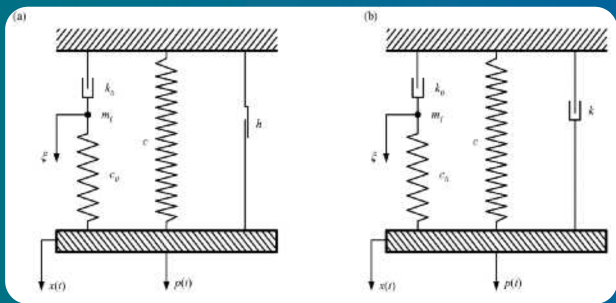
Materials

Analysis and modelling



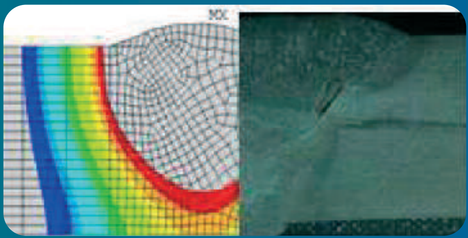
15

The research paper made by J. Krawczyk, J. Pacyna, B. Pawłowski, M. Madej and P. Bała on "The influence of the heat treatment on the microstructure and tribological properties of mottled cast iron" on a **page 15** describes the influence of microstructure changes on GJS-HV300(SiNiCr2-3) cast iron tribological properties. Modification of the investigated cast iron microstructure was carried out by the heat treatment. The tribological tests were performed on the T05 tester at a load of 100 N. Bearing steel 100Cr6 of a hardness of 57 HRC was applied as a counter sample. The test duration time was 2000 s. During the tribological test the continuous measurements of the friction coefficient were carried out and the friction products were being removed from the counter sample surface. The tribological tests were performed at a room temperature. A stereological analysis of volume fractions of structural components (V_V) was performed by means of the point method, with the application of a network deposited on the microstructure photographs. For each variant of the heat treatment 30 depositions of the network were performed. Measurements were done on microphotographs obtained by using an objective of 50 times magnification. The network with 200 measurement points was applied. Heat treatment resulting in decrease of volume fraction of ledeburitic cementite and increase of volume fraction of graphite decreases wear resistance of investigated material. The relationship between the hardness resulting from the microstructure and the wear resistance of the investigated cast iron was presented. This supplements the knowledge concerning the role of the microstructure in the formation of tribological properties of cast iron.

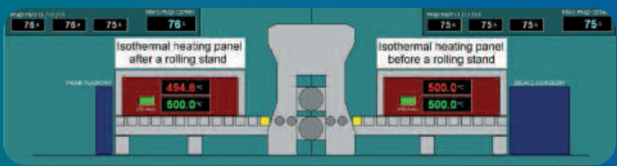


23

The Analysis and modelling section represented by M. Bocian and K. Jamroziak on "The identification of degenerated systems in the impact energy dissipation process" on a **page 23** presents an analysis of impact energy dissipation process with selected non-classical dynamic models. Identification of impact energy dissipation phenomena in mechanical systems with a layered structure (eg, composite ballistic shields) is quite a challenge, because on the one hand it is sought to the model, whose parameters are as much as possible responsible for the energy dissipation, on the other hand, the number of parameters should be optimized. A searched model should be reduced to a simple description of the whole phenomenon and completely imitate entire mechanical system. A description of the impact energy dissipation was modeled with selected degenerated systems in this case. Models were subjected to hammer extortion the specified impulse of force. The mathematical description of pulsed extortion was carried out by using the energy and balance equation of power. Verification of mathematical identification equations for selected model parameters was performed by computer simulation technique. This is an original analytical method, which uses the degenerated systems in various configurations. It involves the use of specially derived identification equations, which are described by the decrease of potential energy of the system during the vibrations induced by a single impulse load. The presented work includes the identification of piercing the ballistic shield, and it is a part of work on the implementation of the degenerated models to describe these phenomena.



31 The paper entitled “Numerical and experiment study of residual stress and strain in multi-pass GMA welding” by R.R. Chand, I.S. Kim, J.P. Lee, Y.S. Kim and D.G. Kim on a **page 31** informs about the selection of an optimal of welding parameter and condition that reduces the risk of mechanical failures on weld structures should be required in manufactory industry. In robotic GMA (Gas Metal Arc) welding process, heat and mass inputs are coupled and transferred by the weld arc to the molten weld pool and by the molten metal that is being transferred to the weld pool. The amount and distribution of the input energy are basically controlled by the obvious and careful choices of welding process parameters in order to accomplish the optimal bead geometry and the desired mechanical properties of the quality weldment. The residual stress and welding deformation have the large impact on the failure of welded structures. The experiment for Gas Metal Arc (GMA) welding process is also performed with similar welding condition to validate the FE results. The simulated and experiment results provide good evidence that heat input is mainly dependent on the welding parameter and residual stress and distortions are mainly affected by amount on heat input during each weld-pass. To achieve the required precision for welded structures, it is required to predict the welding distortions at the early stages. Therefore, this study represented 2D Finite Element Method (FEM) to predict residual stress and strain on thick SS400 steel metal plate. The developed 2D multi-pass model employs Goldak’s heat distribution, to simulate welding on SS400 steel butt-weld joint with a thickness of 16mm. Moreover, the numerical results are validated with experiment results.



38 The paper written by A. Grajcar, P. Skrzypczyk, D. Woźniak and S. Kołodziej on “Semi-industrial simulation of hot rolling and controlled cooling of Mn-Al TRIP steel sheets” on a **page 38** informs about a semi-industrial physical simulation of thermomechanical rolling and controlled cooling of advanced high-strength steels with increased Mn and Al content. Four steels of various Mn and Nb concentration were thermomechanically rolled in 3 and 5 passes using a modern LPS line for physical simulation of hot rolling at a semi-industrial scale. The hot deformation course is fully automated as well as controlled cooling applied directly after finishing rolling. Temperature-time and force-energetic parameters of hot rolling were continuously registered and assessed. The applied line consisting of two-high reversing mill, roller tables with heating panels, cooling devices and controlling-recording systems reflects industrial hot strip rolling parameters sufficiently. Reduction values and temperature-time regimes are similar to those used in industrial practice whereas strain rate is limited to about 10 s^{-1} what requires taking into account during a comparison. All the steels investigated have high total pressure forces due to the high total content of alloying elements. The critical factor making it possible to obtain high-quality sheet samples with a thickness up to 3.3 mm is applying isothermal heating panels which decrease a cooling rate of thin sheets. The efficient semi-industrial physical simulation of hot strip thermomechanical rolling of some new model AHSS grades containing increased Mn and Al content as well as Nb microadditions was presented. The results can be successfully utilized in industrial hot rolling and controlled cooling practices after necessary modifications.

Manufacturing and processing