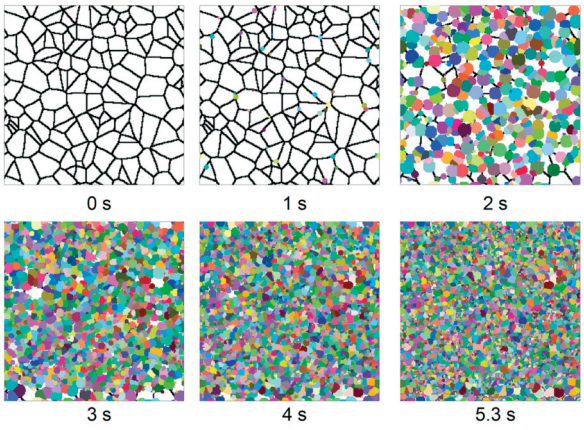
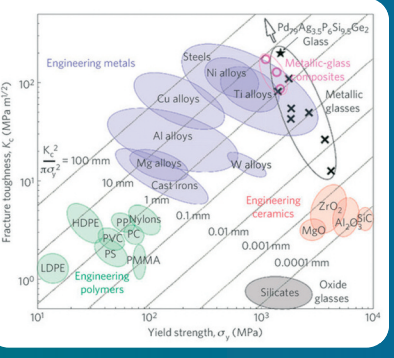
Materials

Properties



147

The research paper entitled "Sustainability issues of research and development of forging" by Y.T. Im, S.K. Hwang, D.K. Kim, H.M. Baek, W.Y. Park, J.W. Lee, H.S. Joo and J.M. Kim on a **page 147** describes the research activities of the Computer Aided Materials Processing Laboratory to improve sustainability of the material and manufacturing process in forging. The friction factors at the punch or die interfaces during cold forging can be determined separately as a function of the hardness and surface roughness of the material and punch or dies, initial yield strength of the material, viscosity of the lubricant, and die velocity. Severe plastic deformation was applied in a continuous manner and strength increase of the material was obtained as a result. The microstructure and texture evolution during recrystallization can be predicted numerically by the developed programme. Empirically obtained non-dimensional equation to determine friction factor was introduced by employing tip test results. Equal channel angular processing (ECAP) and hybrid process consisting of pinch rolling, ECAP, and drawing were newly designed to make the process continuous and improve the strength of the material. The numerical programme based on cellular automata and crystal plasticity was developed to predict microstructure and texture evolution during recrystallization. The current approach is practically easy to apply and the simulation tool developed can replace the laborious and expensive experiments.



202

The paper written by M. Szutkowska on "Fracture toughness of advanced alumina ceramics and alumina matrix composites used for cutting tool edges" on a **page 202** discusses a specific characteristics in fracture toughness measurements of advanced alumina ceramics and alumina matrix composites with particular reference to α-Al_2O_3, Al_2O_3-ZrO_2, Al_2O_3-ZrO_2-TiC and Al_2O_3-Ti(C,N). The present study reports fracture toughness obtained by means of the conventional method and direct measurements of the Vickers crack length (DCM method) of selected tool ceramics based on alumina: pure alumina, alumina-zirconia composite with unstabilized and stabilized zirconia, alumina-zirconia composite with addition of TiC and alumina-nitride-carbide titanium composite with 2wt% of zirconia. Specimens were prepared from submicro-scale trade powders. Vicker's hardness (*HV1*), fracture toughness (K_{IC}) at room temperature, the indentation fracture toughness, Young's modulus and apparent density were also evaluated. The microstructure was observed by means of scanning electron microscopy (SEM). The lowest value of K_{IC} is revealed by pure alumina ceramics. The addition of (10wt%) unstabilized zirconia to alumina or a small amount (5wt%) of TiC to alumina-zirconia composite improve fracture toughness of these ceramics in comparison to alumina ceramics. Alumina ceramics and alumina-zirconia ceramics reveal the pronounced character of *R-curve* because of an increasing dependence on crack growth resistance with crack extension as opposed to the titanium carbide-nitride reinforced composite based on alumina. *R-curve* has not been observed for this composite. The results show the method of fracture toughness improvement of alumina tool ceramics.

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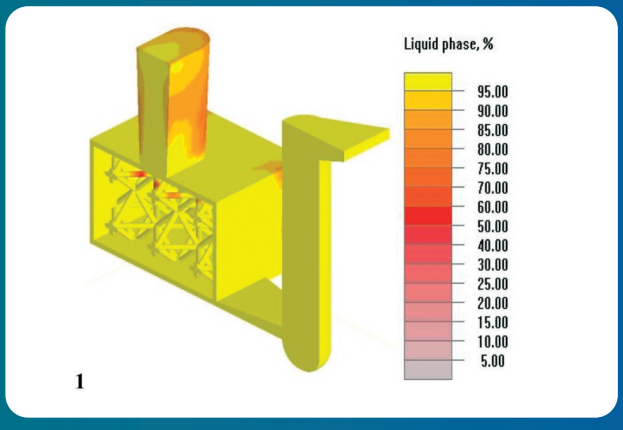
The paper entitled "Application of contemporary engineering techniques and technologies in the field of dental prosthetics" by Budak B. Kosec and M. Sokovic on a **page 233** shows the integration of modern engineering technologies and computer-aided systems into dental prosthetics with special emphasis on efficient manufacture of dental replacements with precision which allows clinical applicability. The subject scope of the paper comprises modelling, manufacturing with special emphases on materials, quality inspection and environmental impact assessment (cleaner production). During the last couple of decades, development of medical science has been marked with an ever more pronounced interdisciplinary character which, in part, can be attributed to various engineering applications. Rapid development of computer-aided technologies, which completely transformed production engineering, also left an indelible mark on dental prosthetics. Striving towards its primary goal – *primum non nocere* ('Above all, do not harm!'), the area of dental prosthetics has introduced numerous novel technologies and methods which allow manufacture of precision, custom-made, optimal dental replacements. The paper evolved on the premise that there is a room for more intensive co-operation between the two disciplines – dental prosthetics and engineering, with a prospect for success of the development of novel, original solutions. In that sense, this paper should serve to both professions – production engineers and dentists.



250

The paper from Manufacturing and processing area made by M. Cholewa, T. Szuter, T. Wróbel and M. Kondracki on "The skeleton castings as a new type of cast lattice structures" on a **page 250** describes selected achievements in field of new type material – skeleton structures. Actual state of knowledge about periodic cellular materials was described. The aim of this work is to show results about mechanically optimised skeleton casting with octahedron topology. Correctness of technological parameters was investigated by microstructural research. Most important parameters of the manufacturing process were identified. The influence of technological parameters to the microstructure in different points of casting was described. Simulations of the mould filling processes were also carried out. Real experiments were performed to prove the simulation results. The qualitative and quantitative metallographic analysis was also carried out. Technological parameters of the skeleton castings manufacturing process were developed. Without use of advanced techniques there is a possibility to manufacture relatively low cost skeleton structures in a typical foundry. It was found out that the octahedron shape of internal cell causes best stress distribution and that the skeleton castings are a good alternative for cellular materials such as metal foams, lattice structures or sandwich panels.

Analysis and modelling

Manufacturing and processing