Manufacturing of materials using external fields

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Editorial

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There has been an increase in research on the interaction between external fields and the structure and properties of materials, with the purpose of seeking solutions that have not been addressed by conventional thermal and mechanical processing. The external fields include electric, magnetic, ultrasonic and stress. Pulsed fields are favoured for minimising energy consumption and sometimes also to avoid certain side effects. Recent research on the subject has been discussed at the 7th International Symposium on Materials in External Fields held in Imperial College London during 22–23 September 2016, where more than 25 participants from China, the Russian Federation, Republic of Korea, Germany and United Kingdom participated with their oral presentations. The papers presented here have been thoroughly reviewed by the independent procedures of this journal, just as would any submission.

Pulsed electric current has been implemented in many processing cases. Materials Science and Technology has published numerous papers on the subject, both from past meetings and unrelated submissions [1]. There exists a popular and incisive critical review of the technology [2]. The latest collection of papers describes the application of electropulsing to clean steel making [3], inclusion agglomeration [4], precipitation [5], corrosion [6], texturing [7], condensation [8] and microstructural alteration [9]. Todorov reports the micro-scale theory of the effect of electric current in bulk materials [10]. Related presentations on the effect of electropulsing on droplet breakup [11] and on low temperature crystal rotation [12] have also been published.

The simultaneous application of electropulsing and ultrasonics for surface processing has been discovered to cause significant alterations in the structure and properties of a variety of steels [13,14]. This potential has been demonstrated also in alloy manufacture. Babutskyi et al. presented the effect of magnetic pulses on Ti-alloys [15]. The evolution of structure and properties of pearlitic steels under long-term mechanical loading has been reported by Victor et al. [16]. Researchers from several UK industries, e.g. MBDA, Lucideon and MPI, have either presented their applications or have participated in the discussions, emphasising perhaps the first significant possibility of commercial exploitation.

As guest editors of this thematic issue and organisers of the 7th symposium (ISMEF'16), we would like to thank the Editors of Materials Science and Technology for supporting our activities and making this thematic issue possible. We also thank all authors and reviewers of the selected papers presented herein for their commitment.

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