Abstracts Book

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Application of Pulse Electromagnetic Field for Metal Coatings Manufacturing

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INTRODUCTION

The technologies of powder compacting and producing of metallic coatings by pulse electromagnetic field (PEMF) exist or are being researched [1-4]. Commonly low energy equipment (0,5-20 kJ) with relatively low or mean frequency of discharge current (1-20 kHz) are used. The aim of research was to investigate the possibility of using of strong PEMF (energy level from 20 to 60 kJ; frequency of discharge current from 30 to 300 kHz) for intensification of the producing and processing metallic coatings and for powder materials transportation as well.

EXPERIMENTAL METHODS

Experiments were carried out on magnetic impulse forming machine BBC-60, (WSU, Germany) (Fig. 1). The temporary (destructible) and stable (permanent) inductor devices were used. By pulse discharge of accumulated energy on the inductor the metallic coatings on steel, polymer and other materials were produced. For characterization of base material surface the Taylor Hobson profilometer Surtronic 25 was used.

Fig.1. Magnetic impulse forming machine BBC-60.

RESULTS AND DISCUSSION

Strong PEMF with frequency of discharge current higher than 100 kHz practically does not influence the porous metallic samples and powders. It is resulting from low conductivity of powder materials and deep penetration of PEMF. It should be mentioned, that preliminary compaction and sintering of powder materials significantly intensify the PEMF influence. Thus, the plastic deformation of powder details and producing of metallic coatings can be done. Best results were achieved when sintered powder details were coated by material with high copper content (10% and more). Qualitative thin coatings from copper foil were achieved when use frequency of discharge starting from 100 kHz (energy from 15 kJ). Using of the frequency of discharge above 300 kHz results in thin layers melting and exfoliation.

CONCLUSION

Strong PEMF with frequency of discharge current higher than 50 kHz is not efficient for processing of non-sintered powder samples. Meanwhile, a producing of thin metallic coatings by means of strong PEMF with frequency of discharge current from 100 to 200 kHz is effective and can be adapted to industrial applications.

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