

A Hybrid Multi-Pole Fe₇₈Si₁₃B₉+FeSi₃ Soft Magnetic Core for Application in the Stators of the Low-Power Permanent Magnet Brushless Direct Current Motors

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Abstract : New types of materials applied as the stators in the Permanent Magnet Brushless Direct Current motors used in the heart supporting pumps are presented. The main focus of this work is the research on the fabrication of a hybrid nine-pole soft magnetic core consisting of a soft magnetic carrier ring with rectangular notches, made from the FeSi₃ strip, and nine soft magnetic poles. This soft magnetic core is made in three stages: (a) preparation of the carrier rings from soft magnetic material with the lowest possible power losses and suitable stiffness, (b) preparation of trapezoidal soft magnetic poles from Metglas 2605 SA1 type ribbons, and (c) making durable connection between the poles and the carrier ring, capable of withstanding a four-times greater tearing force than that present during normal operation of the motor pump. All magnetic properties measurements were made using Remacomp C-1200 (Magnet Physik, Germany) and 450 Gaussometer (Lake Shore, USA) and the electrical characteristics were measured using laboratory generator DF1723009TC (NDN, Poland). Specific measurement techniques used to determine properties of the hybrid cores were presented. Obtained results allow developing the fabrication technology with an account of the intended application of these cores in the stators of the low-power PMBLDC motors used in implanted heart operation supporting pumps. The proposed measurement methodology is appropriate for assessing the quality of the stators.

Keywords : amorphous materials, heart supporting pump, PMBLDC motor, soft magnetic materials

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