RESEARCH ON COMPOSITE SEPARATORS IN HIGH-SPEED SPINDLE BEARINGS WITH IMPROVED LUBRICATION SYSTEMS

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High-speed spindles operating at frequencies exceeding 100,000 RPM present engineers with complex challenges regarding effective cooling and lubrication of bearing assemblies. This paper investigates the potential of innovative composite cage designs for ball bearings with integrated channels for oil mist circulation, representing a novel structural solution for high-speed spindles.

The proposed composite separator is manufactured from multiple components to create channels, which are then joined using press-fitting techniques. This approach enables the creation of complex internal geometry for oil mist circulation in mass production environments. Within the separator, specialized channels are formed that function as an air pump, providing directed lubrication and cooling to the balls and bearing raceways.

The most promising materials for manufacturing composite separators, considering both rigidity requirements and low friction characteristics, are bronze or bearing steel with anti-friction coatings.

The technology for creating channels for air and oil mist circulation in the composite separator is implemented using laser processing, which ensures high precision and reproducibility of results.

Technical challenges in implementation include the need for high-precision balancing of the composite separator, ensuring connection reliability during long-term operation, and preventing channel contamination. Nevertheless, the proposed concept represents a promising direction for the development of bearing assemblies for next-generation high-speed spindles.

Acknowledgment. The research presented in this paper is an outcome of the project VEGA No. 1/0708/24 "Research on the design parameters of the high-speed spinning spindle of the progressive concept" funded by the Scientific Grant Agency of the Ministry of Education, science, research and sport of the Slovak Republic and the Slovak Academy of Sciences.