2B. New generation of aeronautical bearings for extreme environmental constraints . BEARINGS

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Main objective of the project is to propose a new generation of bearings, highly reliable, able to answer the new and extreme constraints on aircraft as: the corrosion and oxidation resistance up to 550°C, impact resistance, low friction torque (constant during life time), contact stress (0 to 5000 Mpa) and vibration level (about 25g). This technological breakthrough is being achieved proposing an innovative technology approach that includes both scientific and technological aspects as:

- selection and development of new nanostructured materials tailored for the strong requirements needed, and their associated processes (high energy milling, plasma spraying and bulk consolidation) designed to keep the nanomaterials advanced properties [1], [2];
- understanding of bearings degradation mechanisms of the behaviour of materials under extreme conditions (temperature, tribological in pressure + shearing conditions) through a coupling between modelling and expertises [3];
- understanding the mechanical, physical, chemical conditions leading to the Superficial Tribological Transformation within the skins of bodies in contact.

In the last year 4 different material systems were developed for both bulk and coating applications. In particular hot compaction was performed by several methods as conventional hot (indirect heating) pressing rapid induction coil heated pressing, as well as Spark Plasma Sintering which it is expected to keep nanostructures as good as possible due to short exposition of heating. All materials have been investigated in terms of density, hardness, microstructure and friction and wear properties on a specifically designed test bench to simulate the real behavior conditions of bearing part. Significant improvements on key target performances compared to the actual material have been found.

CSGI is responsible for the selection and development of nanostructured materials and it is also involved in the management of the project coordinating as work package leader in the WP3: " Tribological material definition and transfer on sample".

References.

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[3] J. Rocchi, Définition d'un problème modèle à partir d'analyses tribologiques : cas d'un contact de géométrie conforme. Diplôme d'Etude Approfondie en Génie Mécanique, Lyon : INSA de Lyon, 2001, 80 p.