Cryogenic machining enables guaranteeing safety of aeronautic sector parts

April 24 2013

CIC marGUNE, the Cooperative Research Centre for High-Performance Manufacture, is coordinating a line of research on cryogenic machining for developing the safety of parts for the aeronautic sector. This machining method has less impact on the environment than conventional methods. Moreover, it considerably enhances the useful life of safety parts and reduces costs. CIC marGUNE is working in collaboration with the High-Performance Manufacturing Group at the Higher Engineering School in Bilbao (UPV/EHU), Tecnalia and the University of Mondragon.

Cryogenic machining involves employing refrigerant gas in the process of machining. CIC marGUNE is coordinating a line of research on cryogenic machining, in which the UPV/EHU, Tecnalia and the University of Mondragón are participating. The aim of the line of research is to guarantee a clean manufacturing process and, moreover, to contribute to the safety of parts in the aeronautics sector.

Machining is a process of manufacturing parts though the elimination of material (swarf). The cutting fluids used in most machining operations producing swarf have two aims: on the one hand, lubricating the cutting zone and, on the other, refrigeration, i.e. eliminating the heat in the cutting zone so as not to affect the machined surface. But these fluids are harmful to the environment and for persons—there are a hundred illnesses associated with this kind of lubricant.

To solve these problems presented by conventional machining methods,

one of the principal alternatives that is being currently investigated is cryogenic machining - an innovative method of refrigerating the cutting tool and the critical points of the part during machining, thanks to the use of a very cold refrigerant gas, which can be liquid nitrogen or CO2.

Both liquid nitrogen and CO2 are basic and cheap products but, moreover, "CO2 can be applied externally to an already existing machine, without the need for any modification to the equipment, greatly saving on investment", according to Mr Franck Girot, coordinator of the CIC marGUNE research line. "There are already proof that the technology functions and so it is a research line directly related to our companies, and which may well arrive on to the market shortly".

Greater safety at lower cost

Safety parts for the aeronautic, automobile, railway, etc. sectors are currently being worked on. Sectors in which parts or components to be machined have to have a certain quality and, above all, not have surface damage, given that a break in a part is generally due to surface defects. This is why, "for these types of applications, cryogenic machining is a guarantee of avoiding such defects" stated Mr Girot. "This is an increasingly more controlled topic, especially in the aeronautic sector", he added. Each part undertaken has specific monitoring so as to know under what conditions the machining has been carried out and, at the same time, to guarantee that the part is not going to break during its life cycle due to surface defects.

Mr Girot highlighted that, in comparison with conventional machining systems, refrigeration of the cutting area which suffers the highest temperature during the process, avoids changes in the microstructure of the tool. This results in enhancements, often notable ones, in certain performance parameters of the materials; outstanding in this respect the

increase in the life of the parts of between 50 and 100 %, in the resistance to wear and tear, in fatigue life, etc.

Moreover, "it is a process totally friendly to the environment, given that no kind of waste or dumping arises", stated Mr Girot. The cryogenic gases are obtained from other processes, and, thus, is a reuse of the gases, which otherwise would have to be eliminated without such benefit. During the machining of the parts, the fluid evaporates rapidly and returns to the atmosphere in a natural manner. The part is left completely clean of impregnations from the cutting fluids and do not produce any waste which might contaminate the machine tool, the swarf or the workplace. This is of major economic importance.

The system can work at higher speeds than those of conventional machining machines. Thus, productivity is increased and work of a higher quality is obtained, resulting in a reduction in the costs of producing the parts.

Provided by Elhuyar Fundazioa

Citation: Cryogenic machining enables guaranteeing safety of aeronautic sector parts (2013, April 24) retrieved 11 July 2024 from https://phys.org/news/2013-04-cryogenic-machining-enables-safety-aeronautic.html