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Feasibility analysis of using machinable glass ceramics to manufacture non-contact measurement approach metrological artefacts

P Zapico[1*], B J Alvarez[1], V Meana[1], A Telenti[2] and E Cuesta[1]

[1] Department of Construction and Manufacturing Engineering, University of Oviedo, Campus of Gijon, Gijón, Spain
[2] PMG Asturias Powder Metal S.A., Polígono Industrial de Baiña, Mieres, Spain

*Corresponding author: zapicopablo@uniovi.es

Abstract: Rather than measurement contact methods, non-contact ones are more desirable in case of on-machine and in-process measurement due to their great accessibility and high acquisition rates. Nevertheless, it is well known that these methods commonly present different issues related to the surface properties of the digitized material and other external factors. Thus, an important characterization work must be carried out by exposing each non-contact technique to different conditions. For this characterization work, the use of metrological gage artefacts is mandatory. These artefacts must be made of materials on which non-contact methods will work properly. Therefore, the analysis of new materials is still an important issue nowadays. Among the current possible materials, those that can be easily formed in typical artefact geometries stand out, while maintaining the required properties such as low thermal expansion, high hardness, etc. In this work the feasibility of a machinable glass ceramic named Macor® to produce a metrological artefact to be used with a non-contact digitizing sensor is analysed. Once stated the benefits of this material and proposed some machining conditions, an artefact is manufactured and digitized with a non-contact laser triangulation sensor, comparing its results regarding to a widely used metrological reference system.

Keywords: Machinable glass ceramic, Macor, Non-contact measurement, Metrological artefact, Laser triangulation.

1. Introduction

In recent decades, numerous non-contact measurement methods have been developed. These methods permit to capture much more quantity of information than contact ones in less time and usually with less problems of accessibility. These advantages convert them in ideal solutions for on-machine and in-process measurement tasks systems. Nevertheless, it is widely known that the quality of the results obtained by them is greatly influenced by different conditions, which are usually indifferent to contact methods. These conditions not only have to do with internal factors of the sensor, as configuration parameters [1], but also with external factors, as the location of the digitized surface with respect to the sensor [2,3], lighting conditions, as well as digitized surface characteristics [4,5]. The latter are related to finishing conditions of the digitized surface, i.e., roughness grade, color, etc., as well as to inherent characteristics of the material itself. This fact, combined with the important need for metrological artefacts that can assess the quality of measurement results and their traceability, reinforces the