IOP Conf. Series: Materials Science and Engineering 1193 (2021) 012058 doi:10.1088/1757-899X/1193/1/012058

Validation of the sandblasting process in the manufacturing of precision spheres for non-contact metrology

E Cuesta[1*], V Meana[1], P Pastur[1], B J Álvarez[1] and P Zapico[1]

[1] Department of Construction and Manufacturing Engineering, University of Oviedo, Campus of Gijón, 33203 Gijón, Spain

*Corresponding author: ecuesta@uniovi.es

Abstract: In order to ensure the measurements that can be made with non-contact metrology technologies, it is necessary to use verification and calibration procedures using precision artefacts as reference elements. In this environment, the need for increasingly accurate but also more cost-effective calibration artefacts is a clear demand in industry. The aim of this work is to demonstrate the feasibility of using low-cost precision spheres as reference artefacts in calibration and verification procedures of non-contact metrological equipment. Specifically, low-cost precision stainless steel spheres are used as reference artefacts. Obviously, in order for such spheres to be used as standard artefacts, it is necessary to change their optical behaviour by removing their high brightness. For this purpose, the spheres are subjected to a manual sandblasting process, which is also a very low-cost process. The equipment used to validate the experiment is a laser triangulation sensor mounted on a Coordinate Measuring Machine (CMM). The CMM touch probe, which is much more accurate, will be used as a device for measuring the influence of sandblasting on the spheres. Subsequently, the influence of this post-processing is also checked with the laser triangulation sensor. Ultimately, the improvement in the quality of the point clouds captured by the laser sensor will be tested after removing the brightness, which distorts and reduces the quantity of points as well as the quality of the point clouds. In addition to the number of points obtained, the parameters used to study the effect of sandblasting on each sphere, both in contact probing and laser scanning, are the measured diameter form error, as well as the standard deviation of the point cloud regarding the best-fit sphere.

Keywords: Sandblasting, Precision spheres, Non-contact metrology, Laser scanning.

1. Introduction

Metrological verification using optical equipment is of increasing interest in industry. The possibility of improving this equipment through adjustment and calibration processes has been one of the main focus of the most recent research [1,2]. The idea is to assess the measurements that can be made with these non-contact technologies, thus extending their application beyond typical reverse engineering applications.

The aim of this work is to validate the sandblasting process as a process for modifying the surface condition of precision spheres in order to use these spheres as reference artefacts for adjustment, verification and/or calibration of optical sensors and non-contact reverse engineering equipment [3].

The final target of this research is to find out whether a low-cost process (manual sandblasting) can be applied to stainless steel precision spheres, of very low cost as well, to materialize calibration spheres for non-contact metrology. It is expected that the loss of precision in both diameter and form error of