Fluidised Bed Machining of Metal Additive Manufactured Parts

A. El Hassanin[1, a)], F. Scherillo[1], A.T. Silvestri[1], M. Troiano[1], A. Squillace[1], P. Salatino[1]

[1]*Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale, Università degli Studi di Napoli Federico II, Piazzale Tecchio 80, 80125 Napoli*

[a)]Corresponding author: andrea.elhassanin@unina.it

Abstract. Additive Manufacturing (AM) can be considered today as a real production technology, which allows to realize parts with a complexity degree that, in some cases, is not achievable otherwise. However, one of the most relevant weak spots is the high surface roughness, especially for metal parts, making necessary the adoption of post-process finishing treatments. This paper deals with the preliminary investigations on the Fluidised Bed Machining technology, in which a sample is dipped into a fluidized bed, i.e. a two-phase system where an abrasive, kept in motion through a gas, behaves like a fluid performing a huge number of impacts on the considered surface. This peculiarity could guarantee a high degree of homogeneity of the treated surface morphology. To evaluate the influence of some of the process parameters, i.e. carrier gas speed and the surface impact angle, experiments have been carried out using AlSi10Mg plates made by Selective Laser Melting Technology (SLM). The fluidized bed employed for the experiments, reported in Figure 1, operated in bubbling fluidization regime. The treatment has been carried out by dipping the samples for a total time of 3 hours and monitoring the results with a step of 30 min for the first 2 hours. The treated surfaces have been characterized by means of Confocal Microscopy to acquire the 3D surfaces, of which an example is reported in Figure 2, and Scanning Electron Microscopy (SEM). Weight loss measurements have been carried out as well for a preliminary evaluation of wear. Results suggests a poor decrease in surface roughness (S_a), as also demonstrated by the poor weight loss, both due to a low impact energy of the abrasives. However, variations of other surface texture parameters (S_z, S_{sk}, S_{ku}), as well as SEM images, suggests that the main surface-abrasive flow interaction phenomena are micro-ploughing and micro-peening.

FIGURE 1. Fluidised Bed apparatus.

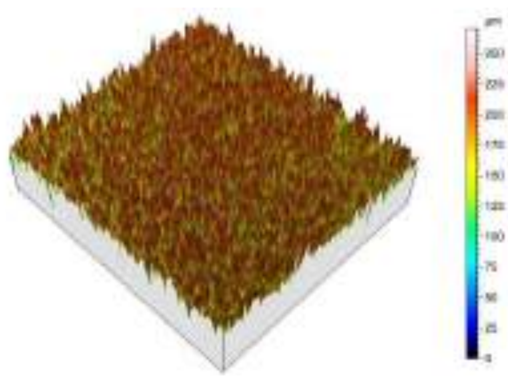

FIGURE 2. 3D surface of a treated sample.