

Ultra-High Precision Diamond Turning of Infrared Lenses

Authors : Khaled Abou-El-Hossein

Abstract : The presentation will address the features of two IR convex lenses that have been manufactured using an ultra-high precision machining centre based on single-point diamond turning. The lenses are made from silicon and germanium with a radius of curvature of 500 mm. Because of the brittle nature of silicon and germanium, machining parameters were selected in such a way that ductile regime was achieved. The cutting speed was 800 rpm while the feed rate and depth cut were 20 mm/min and 20 μm , respectively. Although both materials comprise a mono-crystalline microstructure and are quite similar in terms of optical properties, machining of silicon was accompanied with more difficulties in terms of form accuracy compared to germanium machining. The P-V error of the silicon profile was 0.222 μm while it was only 0.055 μm for the germanium lens. This could be attributed to the accelerated wear that takes place on the tool edge when turning mono-crystalline silicon. Currently, we are using other ranges of the machining parameters in order to determine their optimal range that could yield satisfactory performance in terms of form accuracy when fabricating silicon lenses.

Keywords : diamond turning, optical surfaces, precision machining, surface roughness

Conference Title : ICCEC 2017 : International Conference on Competitive Engineering and Creativity

Conference Location : Zurich, Switzerland

Conference Dates : April 20-21, 2017