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A.H. Galmed, A. du Plessis, S.G. le Roux, E. Hartnick, H. Von Bergmann, M. Maaza

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Three Dimensional Characterization of Laser Ablation Craters Using High Resolution X-Ray Computed Tomography

A. H. Galmed [1,2,6*], A. du Plessis [3], , S. G. le Roux [3], E. Hartnick [3], H. Von Bergmann[4], M. Maaza [5,6]

[1] National Institute of Laser Enhanced Sciences (NILES), Cairo University, Egypt

[2] Materials Research Department (MRD), iThemba LABS-National Research Foundation (NRF), 1 Old Faure Road, P. O. Box 722, 7129 Somerset West, Western Cape, South Africa.

[3] University of Stellenbosch, CT Scanner Facility, Private Bag X1, Matieland, Stellenbosch 7602, South Africa.

[4] Laser Research Institute (LRI), Physics Department, University of Stellenbosch, Stellenbosch, South Africa.

[5] Nano-sciences African Network (NANOAFNET), Materials Research Department, iThemba LABS-National Research Foundation of South Africa, Old Faure Road, PO Box 722, Somerset West 7129, Western Cape, South Africa.

[6] UNESCO-UNISA Africa Chair in Nanosciences/Nanotechnology, College of Science, Engineering and Technology, University of South Africa, Muckleneuk ridge, PO Box 392, Pretoria, South Africa.

Abstract:

Laboratory X-ray computed tomography is an emerging technology for the 3D characterization and dimensional analysis of many types of materials. In this work we demonstrate the usefulness of this characterization method for the full three dimensional analysis of laser ablation craters, in the context of a laser induced breakdown spectroscopy setup. Laser induced breakdown spectroscopy relies on laser ablation for sampling the material of interest. We demonstrate here qualitatively (in images) and quantitatively (in terms of crater cone angles, depths, diameters and volume) laser ablation crater analysis in 3D for metal (aluminum) and rock (false gold ore). We show the effect of a Gaussian beam profile on the resulting crater geometry, as well as the first visual evidence of undercutting in the rock sample, most likely due to ejection of relatively large grains. The method holds promise for optimization of laser ablation setups especially for laser induced breakdown spectroscopy.

Key Words: Computed Tomography (CT), Ablation, Crater, Average Ablation Rate (AAR)

* corresponding author: A. H. Galmed

Ahmedgalmed@niles.edu.eg