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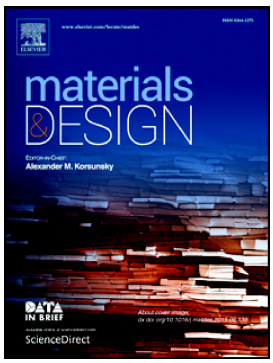

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PII: S0264-1275(18)30068-6
DOI: https://doi.org/10.1016/j.matdes.2018.01.054
Reference: JMADE 3657

To appear in: *Materials & Design*

Received date: 31 October 2017
Revised date: 24 January 2018
Accepted date: 26 January 2018

Please cite this article as: Ranggi S. Ramadhan, Abdul K. Syed, Anton S. Tremsin, Winfried Kockelmann, Robert Dalgliesh, Bo Chen, David Parfitt, Michael E. Fitzpatrick , Mapping residual strain induced by cold working and by laser shock peening using neutron transmission spectroscopy. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Jmade(2017), https://doi.org/10.1016/j.matdes.2018.01.054

Mapping Residual Strain Induced by Cold Working and by Laser Shock Peening using Neutron Transmission Spectroscopy

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Abstract

This paper presents 2D mapping of residual strains, induced by cold expansion and laser shock peening processing of aluminium alloy samples, by using Bragg edge neutron transmission. Neutron transmission uses information contained in the neutron beam transmitted through a sample. It is shown that neutron transmission strain mapping with high spatial resolution can provide important insights into the distribution of residual strains associated with processing of materials. The residual strain field around a cold-expanded hole can be revealed in detail, as can be the residual strain profile associated with laser peening. Results are correlated with measurements obtained by conventional neutron diffraction and incremental hole drilling. The residual strain variation around the cold-expanded hole and the depth of compressive residual strain generated by the peening process were captured with high spatial resolution, showing the advantages of neutron transmission over other well-established strain measurement methods by non-destructively generating a map of residual strains over a large area.

Keywords: Neutron transmission; Residual strain; Strain mapping; Bragg edge analysis; Cold expansion; Laser shock peening