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PII: S0257-8972(18)30814-4
DOI: doi:10.1016/j.surfcoat.2018.08.009
Reference: SCT 23667

To appear in: *Surface & Coatings Technology*

Received date: 4 May 2018
Revised date: 2 August 2018
Accepted date: 3 August 2018

Please cite this article as: Deepak Sharma, Prakriti Kumar Ghosh, Sudhir Kumar, Sourav Das, Ramkishor Anant, Nilesh Kumar , Surface hardening by in-situ grown composite layer on microalloyed steel employing TIG arcing process. Sct (2018), doi:10.1016/j.surfcoat.2018.08.009

Surface Hardening by *in-situ* Grown Composite layer on Microalloyed Steel Employing TIG Arcing Process

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Abstract:

Surface of microalloyed steel, hereafter referred as steel, has been modified by developing an *in-situ* grown composite case on its surface for improved hardness. It is done through surface melting by employing Tungsten Inert Gas (TIG) arcing. The hard reinforcements were made to grow in the surface matrix of steel through chemical reactions of the inorganic powders present in the applied coating and the molten base. The distribution and incorporation of these reinforcements were taken care by addition of Al and TiO_2 in the coating. Three different mixtures, comprising different proportions of Al and TiO_2, were prepared to develop a hybrid composite primarily containing Al_2O_3 and a small fraction of TiC along with other oxides as reinforcements. The modified particulate composite surface was analyzed under Vickers' micro-hardness tester confirming its significant improvement in hardness of the order of 1.88-2.24 times in comparison to that of the base metal, depending upon different chemistry of the powder mixture of the coating.

Keywords: TIG arcing, Marangoni effect, surface hardening, *in-situ* grown composite, steel