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# Multi-scale characterization of a high chromium hardfacing alloy for ballistic protection applications

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## Abstract

Hardfacing process is currently widely used for the protection of materials and structures exposed to complex and severe environments **(1-2)**. This technique involves the fusion application of a protective coating onto a surface, significantly enhancing its resistance to wear, corrosion, and other forms of degradation. In sectors such as aerospace and automotive, hardfacing extends the lifespan of components and preserves their performance over time. However, its application in the field of ballistic protection remains relatively unexplored, even though research and development of new armor systems are crucial in light of the rapidly evolving current kinetic threats. The use of this technique could not only significantly increase the impact resistance of armor but also maintain the mobility of structures and the cost-effectiveness of deployed solutions. In this context, the work presented here focuses on the analysis of a bilayered passive protection composed of a S355MC steel substrate ( $C < 0.2\%$  by weight) with a thickness of 8 mm, onto which a material of the same thickness, equivalent to a highly alloyed chromium cast iron (Cr: 27-30% by weight; C: 4-6% by weight), is applied using flux-cored arc welding (FCAW). Impact tests were conducted on several units using a 7.62x51 mm caliber projectile, equivalent to the M61, on the instrumented ballistic testing facility of the Franco-German Research Institute of Saint-Louis (ISL). A comprehensive microstructural analysis of the composite is proposed and linked with target damage during impact. Additionally, a model of the welding deposit used is presented with a view to the numerical simulation of ballistic tests.

**(1)** Maria-Rosa ARDIGO-BESNARD, Arnold TELLIER, Aurélien BESNARD, Jean-Philippe CHATEAU-CORNU - Effect of the microstructure on the tribological properties of HIPed and PTAWelded Fe-based hardfacing alloy - Surface and Coatings Technology - Vol. 425, p.127691 - 2021

**(2)** Shibe, & Chawla, Vikas. (2013). Enhancement in wear resistance by hardfacing: a review. *Mechanica Confab.* 3.

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