JOURNAL OF MATERIALS PROCESSING TECHNOLOGY 200 (2008) 410–415

journal homepage: www.elsevier.com/locate/jmatprotec

Study of microstructure, phases and microhardness of metallic coatings deposited by flame thermal spray

Mohand Amokrane Bradai[a,*], *Nedjemeddine Bounar*[b], *Abderrahim Benabbas*[b], *Abdelaziz Ati*[a]

[a] Laboratory of Technology of Materials and Engineering of the Processes, Faculty of Science and Science Engineering, University of Béjaïa, Béjaïa 06000, Algeria

[b] Laboratory of Interaction of Materials and Environment, University of Jijel, Jijel 18000, Algeria

ARTICLE INFO

Article history:
Received 28 January 2007
Received in revised form
25 April 2007
Accepted 22 August 2007

Keywords:
Flame spraying
Coating microstructure
Bond coat
Microhardness tests
XRD/EDS

ABSTRACT

The recharging technique by thermal spraying offers the opportunity of renovating the worn surface parts of a machine element to give it again a new technical life despite its previ- ous degradation in service. This process has consequently interesting economic impacts. In order to improve the adherence between 100Cr6 steel deposits and the substrate material (left worn crankshafts), company SNC ATRA of Béjaïa uses at present a composite formed by (100Cr6 steel/molybdenum bond coat of 0.2 mm thick/crankshaft substrate). As a matter of fact, it is shown in the present work that the molybdenum bond coat is not appro- priate since, for the 0.2 mm thickness, lateral cracks are observed in the middle of the bond coat. On the other hand, our experiment is that a deposit of 100Cr6 steel projected directly on the substrate seems more promising since no gaps or cracks were detected at the "deposit/substrate" interface of this two-material composite. Lastly, phase analysis using X-ray diffraction confirmed that during spraying process, a stable α-phase (bcc) of 100Cr6 wire was transformed to a new phase of μ-phase (fcc). The coatings exhibited the higher microhardness which would contribute to increase wear resistance.

1. Introduction

Thermal spraying consists of a set of processes used to deposit, on a previously prepared surface, layers of metallic or non-metallic materials.

In thermal spray processes, the deposited material is melted or heated by the combustion of gases, an electric arc or plasma. All these techniques permit the deposition of coating materials, generally ductile, with self-lubricating properties and improved corrosion and wear resistance. The impact against the substrate surface flattens the particles and produces adhesion to the substrate in a direction par- allel to it by the interlocking of the molten or semi-molten particles with asperities of the roughened surface. Further deposition occurs onto already deposited particles, generating a layer with particular characteristics, different from any other metallurgical form Krepski (1993). Nevertheless, Combustion Flame Spray is classically used in the restoration of the worn mechanical elements submitted to frictions in service to reach again the correct original thickness after a large technical life (Thorpe, 1993). A projected coating is of high quality when good cohesion of the deposit is obtained as well as high adherence of the coating on its substrate. If the adherence proves to be insufficient bonds coat are commonly used among which molybdenum or alloys of the type NiAl (Laribi et al., 2003; Wu et al., 2004; Hjörnhede and Nylund, 2003),

* *Corresponding* AUTHOR. Tel.: +213 34 21 51 05; fax: +213 34 21 51 05.
E-mail address: mokbrad@yahoo.fr (M.A. Bradai).
0924-0136/$ – see front matter © 2007 Elsevier B.V. All rights reserved.
doi:10.1016/j.jmatprotec.2007.08.048