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Edited by:

SIMON SEDMAK
BRANISLAV ĐORĐEVIĆ
JOSÉ António Fonseca de Oliveira CORREIA
ABÍLIO Manuel Pinho DE JESUS
ALEKSANDAR SEDMAK

DIVK

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Title

PROCEEDINGS OF THE SECOND INTERNATIONAL SYMPOSIUM ON RISK ANALYSIS AND SAFETY OF COMPLEX STRUCTURES AND COMPONENTS - IRAS 2023

Editors
SIMON SEDMAK
BRANISLAV ĐORĐEVIĆ
JOSÉ António Fonseca de Oliveira CORREIA
ABÍLIO Manuel Pinho DE JESUS
ALEKSANDAR SEDMAK

Coordinator
JOSÉ António Fonseca de Oliveira CORREIA

Design
Simon Sedmak, Branislav Đorđević

Event Center
Faculty of Mechanical Engineering, University of Belgrade, Serbia

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Properties of aluminum-steel plates explosively welded using Amonex explosive

M. Lazarević[1]*, B. Živković[1], D. Bajić[2], A. Alil[3], B. Nedić[1]

[1]*University of Kragujevac, Faculty of Engineering, Serbia*
[2]*Military Technical Institute, Belgrade, Serbia*
[3]*University of Belgrade, Innovation Center of the Faculty of Technology and Metallurgy, Serbia*
*corresponding author: simic_danica@yahoo.com

Abstract

Besides their application in munitions and armaments, explosives have a significant role in industrial applications, such as cladding or welding of metal plates. In the process of explosion welding, the energy of explosive detonation is used to achieve a metallurgical bond between two metal components, which are metallurgically compatible, but also those that are non-weldable by conventional methods. For this purpose, most often explosives of low values of detonation velocity are used, in order to avoid severe damage to the processed metal plates.

The aim of this study was to investigate the possibility to use the industrial explosive Amonex, which belongs to a group of low-to-middle detonation velocity explosives, for welding of metallic materials. It consists of ammonium nitrate and TNT as energetic components and other inert ingredients and has a powdery consistency, easily applicable in a desirable layer over the metal plates to be welded. Within this research, Amonex was applied to weld plates of aluminium Al 2024 and steel Č0345. Besides the initial data on the used metal plates, the main properties of the used explosives are also given, since based on these properties the needed quantity of explosive was estimated. The procedure of welding was carried out in the configuration of parallel plates, and afterward the welded joint was examined. Ultrasonic method and chemical penetrants were used as non-destructive techniques, and then the samples were cut from the welded plate using water-jet, in order to perform microscopic analyses on the cross-section and to determine the indentation hardness in the area of the joint. It was observed that a good-quality welded joint was obtained, and that the selected explosive may find further application in this area.

Keywords: explosion welding; steel; aluminium; non-destrustive testing; indentation hardness