

## **Microscopy of nanostructures**

### **Influence of nanoscale components of non-metallic inclusions on weld metal microstructure formation**

**V.V. Golovko, S.M. Stepanuyk, D.Yu. Iermolenko**

*Metallurgy of Arc Welding and Welding Consumables Department, Paton Electric Welding Institute, Natl. Acad. of Sci. of Ukraine. Bozhenko St, 11, Kiev-03680, Ukraine.*

*E-mail: ermolenkopewi@gmail.com*

During weld metal microstructure formation, the ability to influence on their mechanical properties is substantially reduced in comparison with the technology of steel production.

To investigate the possibility of improving the performance of welds strength and toughness by size, composition and morphology of nonmetallic inclusions, carbides and nitrides of alloying elements were added to molten weld pool. The particles of size less than 0.5 microns were used.

It was established that the presence of a certain amount of nonmetallic inclusions in the weld metal is a necessary condition for obtaining the microstructure, which can provide high strength, ductility and toughness of the weld metal. Data analysis showed that the positive influence on the microstructure and mechanical properties of the weld metal produced by inclusions with size from 0.3 to 0.8 microns, which have a multiphase morphology, and contain nano-sized titanium carbide formations on the outer layer. These inclusions have a core of aluminum oxide and multilayer cover of galaxite and titanium oxide with sulphide or carbide phase on the surface. Inclusions of such morphology were observed in the case of adding nanoscale particles of titanium carbide into the molten weld pool. The part of these inclusions does not exceed 30%, but they determine conditions for the microstructure formation and level of the weld metal mechanical properties.