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# Transformation characteristics of hardfacing deposits applied by a hard particle core sheathed electrode

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**Abstract.** This study investigates a novel welding electrode developed by the authors, which consists of a mixed powder core of cermet and cemented carbide encased in a low-alloy steel sheath. The weldability of the electrode and the characteristics of the deposit are evaluated. The weldability of the electrode for hardfacing and a maximum hardness of 700 HV for the as-welded deposit are as good or better than that of a similar type of commercial hardfacing electrode. TiC is the main component of cermet and it is distributed in the deposit as MC carbide which consists from (Ti,W)C carbide with TiC core by including tungsten. The main component, WC, of the cemented carbide melts into the deposit metal as alloy content or crystallises as $M_6C$ or $M_2C$. Thus, MC carbide, $M_6C$ carbide and $M_2C$ carbide are contained in the deposit metal similar to a high-speed steel. Moreover, since the deposits not only disperse the carbide but also contain the element that comes from the cermet or cemented carbide, a secondary hardening and softening resistance at high temperatures can be expected. Variations in the hardness and the structure from the as-welded condition are investigated by increasing the tempering temperature. The results show that the transformation microstructure and the hardness of the deposits are affected by carbon, titanium, tungsten, chromium and other elements, which are derived from the mixture of hard powders in the core rod and/or the elements in the coating flux. The hardness of the deposits in the as-welded condition ranges from 565 to 708 HV, with the values mainly affected by carbon content and carbide-forming elements such as tungsten and chromium. By tempering at a temperature near 500°C, the peak hardness of the deposits is raised above 800 HV. The secondary hardening value is affected by the ratio of hard particles to coating flux, and the maximum hardness of 800 HV is greater by around 150 HV than the as-welded hardness.

***Keywords:*** *hardfacing, cermet, cemented carbide, abrasive wear, carbide, welding, surfacing, deposit*