ABSTRACT

Weldability of Tool Steels

Ramesh Chansingh

Welding of tool steels has been limited because of their thermal sensitivity. However it is often necessary particularly for repairs. While some techniques for the welding repair of hardened tool steels have been developed, their success has often been questionable. Better chances for success occur with the welding of an annealed part. Even with an annealed part, however, the welding operation is difficult. Surprisingly very little has been reported in the literature on the weldability of tool steels.

In this report a comprehensive review of the weldability of tools steels has been done together with an analysis of the structures of common tool steels welded and either slow-cooled in limestone, cooled in air or cooled in air then tempered. Two different welding processes were used to join tool steels; these processes were shielded metal arc welding and resistance welding. Shielded metal arc welding was used on water-hardening (W1), air-hardening (A2) and high-carbon high-chromium (D2) tool steels, while resistance welding was used on air-hardening (A2) and

high-speed steel (M2). Physical and microstructural tests were then performed on the welded specimens.

A successful weld repair of tool steels is dependent on the filler metal, welding technique and equipment. The skill and experience of the welder to perform maintenance welding is also of great importance. A careful handling of electrodes, correct joint preparation, selection of suitable preheating temperatures and weld sequence are factors which must be given attention in order to perform an optimal weld repair.

It was found that the welding of tool steels should always be followed by slow-cooling of the welded joint. Any other form of cooling would either produce unwanted microstructures, cracks in the weld resulting in reduced strength or other undesirable qualities.