
Effect of workpiece heat treatment on surface quality of AWJ kerf

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Abstract: Abrasive water jet (AWJ) can be effectively employed on a broad selection of work materials, ranging from polymers to lapideous materials and high grade steels. The AWJ cutting process involves several variables, including hydraulic, abrasive, mixing and cutting parameters. Moreover workpiece properties, mainly modulus and hardness, affect material removal type (cutting and deformation wear mode). This paper concentrates on the influence of the mechanical properties of the workpiece on kerf roughness that is achieving more and more attentions from manufacturers, aiming towards near net shape production. In particular, the same carbon steel (C40 UNI EN 10083-2) was used for all tests; two heat treatments were performed on different specimen sets. AWJ cuts on 'as is' (normalised) and hardened specimens (water-quenched) were realised using different traverse speed. The surface roughnesses of the kerfs at different depths were measured to evaluate process performance. A statistical analysis was carried out to assess the significance of the results. It was found that workpiece hardness affects surface finish in different ways, depending on water pressure, traverse rate and depth of measurement across the kerf. Such results support the theory about two different material removal mechanisms, activated at different levels of jet erosive power.

Keywords: abrasive waterjet; cutting quality; erosive power; kerf; heat treatment.

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Biographical notes: Michele Monno is a Full Professor of Manufacturing and Production Systems at the Politecnico di Milano from 2004. She is the Director of the Machine Tools and Production System Laboratory in Piacenza, Italy from 2006.