**Effects of Electrical Discharge Machining on Fatigue Behaviour of AISI D2 Steel**

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**Abstract** Nowadays, competition prevails and the economic problems are a constant issue. It is necessary to look for new ways to produce faster and with better quality with minimum costs. For this reason, companies are looking for ways to deviate from standard procedures and bet on processes that allow working with innovative materials with unique characteristics. It is in this background that Electrical Discharge Machining (EDM) gains emphasis because it can be applied to materials which are difficult or even impossible to machine by conventional methods.

The fatigue phenomenon is mainly superficial and, as such, can be affected by various aspects such as the surface quality of material or the presence of residual stresses at the surface, aspects which may arise in the EDM process. It is in this context that this work fits, in which the main goal is the study of the effects of EDM and the effect of the changes in EDM parameters on the surface of the material, particularly in the fatigue behaviour. For this purpose, the steel for cold working tools, AISI D2, used in components subjected to high wear making part of moulds, is investigated in this work. Specimens are machined by the EDM process using two different sets of parameters and three point bending fatigue tests of rectangular specimens are performed with a stress ratio of 0.1 and their behaviour is compared to the fatigue behaviour of grinded samples.

The results show that the material used has a very heterogeneous microstructure in which there are numerous chromium carbides of high dimensions with a no uniform distribution and arranged vertically in thickness direction of the test pieces, hindering the machining process and negatively affecting the fatigue behaviour of the material. The EDMed specimens show a microstructure characteristic of this process divided into three distinct zones: white layer, heat-affected zone and base metal zone. The white layer shows a very brittle behaviour with a cracking pattern. Also the roughness of the EDMed specimens was higher to the roughness of grinding specimens. The fatigue behaviour is also significantly affected by the parameters used in EDM machining and the EDM process itself, when compared to the grinding process. The grinding specimens showed longer fatigue lives than EDMed specimens. Residual stresses evaluated by XRD on EDMed specimens and grinded specimens were consistent with the distinct fatigue behaviours.