Summary of the project Smart machine

CTI-No. *18204.1 PFIW-IW*

Introduction

Wire EDM is a widely used but time consuming process which requires several, (cost significant), consumables like wire, filters or deionization resin. The objective of the project was to develop a model (e.g. software) which is able to predict the status & future capacity of consumables and wear parts based on machining history and sensor inputs. This model allows to avoid down-times of machine and allow to better use of (already partially used) consumable and thus allow to reduce waist and cost. It is also a significant step in the automation of (wire EDM) machines and toward intelligent production "industrie 4.0" with autonomous, self-adapting machines and processes, as the machines could select the best suited tasks in terms of desired quality and quantity taking into account their actual capacity.

Industrial context.

Today WEDM users exchange wear and consumable parts well before their maximum capacity to avoid machine breakdown during long unmanned machining hours. Thus they demand a reliable prediction model, both to reduce costs by best usage of consumable capacities as well as to avoid machine break-down.

Tests and model

To build up such a prediction model, a fundamental understanding of the physics and chemistry related with the EDM process was required and several hundreds of hours test machining had been done to determine the parameters of the model. The machine was equipped with additional sensors and online measurement of pressure drops in filters, flow rate, filter weight, electrical conductivity, pH & Redox etc. for different material was done. Based on the known, registered machining history and the actual measurement values, this model is able to predict the remaining capacities, e.g. allows for a given task to assure that this job could be finished (or not).

Model of the dielectric circuit of a WEDM machine	Pressure drop in filters during 500 hours of machining
Variation of dielectric conductivity during 300 h of machining	Schematic view of some elements of the prediction model