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DocMASE Project Proposal 2012-08

Project Title	***Defined structured cemented carbide tools for abrasive machining processes***
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Project Description	A new possible approach to construct balanced and reproducible tools for abrasive processes, e.g. honing, is the production of wear-resistant material with a defined surface structure. One possible material group could be cemented carbides. Cemented carbides are known as a wear-resistant tool material from several cutting processes. Basically, defined structures can be inserted in cemented carbides by electro-chemical machining (ECM) or electrical discharge machining (EDM). Today's advanced precision machines for ECM and EDM involve the requirement to produce repeatable very precise structures. The composition of the different cemented carbides, with different types of carbide (e.g. TiC, WC, NbC), grain sizes and different metallic contents, offers many possibilities to influence the characteristics of such an abrasive tool. Thereby, form and size of the grains, the machining process and the topography to be produced interact. In further steps of development CBN or other abrasive grains may be sintered into the material composites as an extension to the use of cemented carbides with an already known composition. From a research point of view basic questions have to be clarified in advance: • Requirements concerning the composition and characteristics of the cemented carbide considering the manufacturing with ECM or EDM and the load during application in an abrasive process • Determination of an optimal surface structure for the tool • Behavior of the different components of the cemented carbide during ECM and EDM and determination of convenient process parameters • Effects of ECM and EDM on surface integrity and tribomechanical properties • Wear- and process behavior during the application of the tools using the example of the honing process In a joint doctoral thesis (PhD), a first basis of the new tool technology may be provided by theoretical considerations and experimental analyses.
References	Burkhard, G.; Rehsteiner, F.: High Efficiency Abrasive Tool for Honing. Annals of the CIRP, Vol. 51/1, 2002, pp. 271-274. Jahan, M. P.; Rahman, M.; Wong, Y. S.: A Review on the Conventional and Micro-Elektrodischarge Machining of Tungsten Carbide. International Journal of Machine Tools & Manufacture, 2011.
Previous Publications	Llanes, L.; Casas, B.; Idañez, E.; Marsal, M.; Anglada, M.: Surface Integrity Effects on the Fracture Resistance of Electrical-Discharge-Machined WC-Co Cemented Carbides. J. Am. Ceram. Soc., Vol. 87/9, 2004, pp. 1687-1693. Casas, B.; Torres, Y.; Llanes, L.: Fracture and Fatigue Behavior of Electrical-Discharge Machined Cemented Carbides. International Journal of Refractory Metals & Hard Materials, Vol. 24, 2006, pp. 162-167. Bähre, D.; Schmitt, C.: Analysis of Forces and Process Behaviour during the Honing of Bores. Proceedings of the 4th CIRP HPC 2010, Vol. 1, pp. 23-26.