

ABSTRACT - POSTER**GODRILL project – Indirect additive manufacturing of gradient composition object for drilling applications**

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Abstract

In the extractive industry, particularly in mining drilling and energy production, diamond inserts must meet high standards of reliability and performance, which necessitates the design of complex components. 'Near-net-shape' forming processes offer a promising solution. The Win²wal GODRILL project, a collaboration between the University of Mons (Mons, Hainaut, Belgium), the CRIBC research centre (Mons, Hainaut, Belgium) and the SME Diarotech (Fleurus, Hainaut, Belgium), aims to develop diamond-sintered tungsten carbide components with composition gradients using the gel casting process combined with moulds produced by 3D printing. This project will therefore enable the development of an innovative production method that will ensure greater product diversity and improved competitiveness for diamond tools.

Among the various processes, gel casting is a technique that has been extensively studied. The main challenges relate to:

- Development of stable formulations that do not settle and are suitable for casting;
- Selection of polymer for printing;
- Optimisation of drying and heat treatment processes.

The University of Mons is primarily involved in the stages of developing stable, castable formulations and characterising the components. The results obtained during these stages, together with the research centre's findings, will enable the university to present a prototype to Diarotech at the end of the project.

The first step is the investigation of the stability of the tungsten carbide powder, supplied by Diarotech, in an aqueous solution. To this end, various gelling agent/dispersant systems are investigated through casting trials and viscosity measurements. The castings undergo heat treatment to investigate the influence of the various gelling agent/dispersant systems on the castings. Initial viscosity tests show that the suspensions are castable and have viscosities well below those reported in the literature ($<1 \text{ Pa.s}$ at 100 s^{-1}). These suspensions were cast, and the resulting pieces underwent debinding and sintering heat treatments. Dimensional measurements show a shrinkage of around 20% for a relative Archimedes' density of around 90%.

Keywords: Gel Casting, Cemented Carbide, Sintering, Rheology