Effect of binder composition on sintering and microstructure of cemented carbides

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Jury :

- Mme Elena GORDO ODERIZ, Professeur à l'Université Carlos III de Madrid, Rapporteur
- Mr Francis DELANNAY, Professeur à l'Ecole Polytechnique de Louvain, Rapporteur
- Mr Tomas A PERSSON, Ingénieur de Recherche à Seco Tools, Examinateur
- Mr Sylvain MEILLE, Professeur à L'INSA Lyon, Examinateur

Abstract: Cemented carbides are used in the cutting tools industry thank to their exceptional mechanical properties. Manufactured by the powder metallurgy route, they are made of a hard WC phase with a ductile metallic binder, most commonly Co. Since European commission REACH classified cobalt as possibly carcenogenic material, new metallic binders have to be considered: iron and nickel binders are investigated in this work. Since cobalt is the most common binder used in the hard metal industry, there is still a lack of knowledge regarding the specific effect of the binder composition on sintering and grain growth of cemented carbides. This work aims at understanding this effect. High C/W ratio delays the shrinkage of cemented carbides whatever the binder. In addition, solid state sintering is delayed to higher temperature for WC-Fe in comparison to WC-Co and WC-Ni alloys. Grain growth is inhibited for low C/W ratio whatever the binder nature, but for a high C/W ratio, grain growth is enhanced and the abnormal character of grain growth increases, especially in the case of Ni binder.