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The effect of chromium content on cutting performance and oxidation resistance of TiAlCrN coatings

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Improvement of the durability and cutting performance of coatings designed for tools is an ongoing engineering challenge. There are two main paths to achieve such ambitious goal: to enhance oxidation resistance and/or to decrease friction. In this investigation we is focused on laboratory and industrial performance of TiAlN coating with higher oxidation resistance due to various content of chromium. The objective of the work is to increase the cutting speed of drillers.
TiAlCrN coatings with different content of chromium were deposited by unbalanced pulsed magnetron sputtering CemeCon 880 MLT industrial apparatus. TiAlN coatings were deposited as reference. The coatings were deposited on WCCo standard drills and cutting inserts to test their performance either in laboratory by drilling high-speed steel and Inconel as in real production by industrial partner. To measure oxidation resistance, oxidation speed was measured by thermogravimetric analysis (TGA); in this case fecralloy substrates were used. Tribological measurements were performed on CSM tribometer at temperatures up to 800°C. The worn surfaces, both from tribometer and real tools, were investigated by scanning electron microscopy equipped with Energy-dispersive X-ray spectroscopy (EDX) and by Raman spectroscopy. The wear was measured by 3D white light optical profilometry. Oxidation tests and tribological properties obtained in laboratory were compared with the behavior of the coatings deposited on tools.

Keywords
TiAlCrN
coating tribology
thermal stability