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The use of the addition of Cr_3C_2 in nanocrystalline sintered carbides to create a composite tool material with better operational properties

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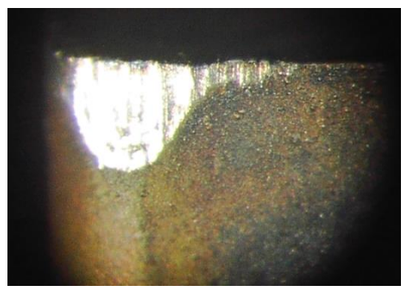
Abstract: WC-Co type sintered carbides are the most frequently used composite tool material for cutting blades. Reducing the grain size of composite tool materials is one of the ways to modify the microstructure, allowing for a significant increase in mechanical properties of cutting tool edges. This type of modification in a polycrystalline material hinders the generation and mobility of dislocations, as well as the spread of microcracks already existing in the material. This work presents the results of comparative tests on the wear and durability of nanocrystalline carbides sintered without and with the addition of Cr_3C_2. The addition of Cr_3C_2 was used to limit the growth of tungsten carbide nanocrystalline powder grains during sintering. The modification of the chemical composition of sintered nanocrystalline carbides was aimed at creating cutting blades with even greater wear resistance than WC-Co nanocrystalline carbides without a growth inhibitor, with a view to their effective use in machining increasingly common difficult-to-cut construction materials.
Keywords: composite materials, nanocrystalline structure, cutting tools.

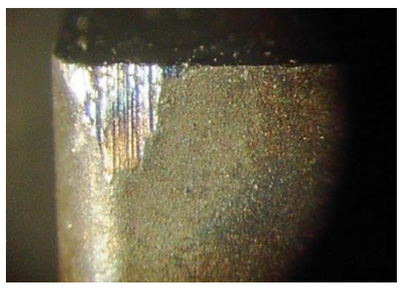
Test conditions

Cutting inserts are made of:
- nanocrystalline sintered carbides type WC-5% by weight Co,
- nanocrystalline sintered carbides type WC-5% by weight Co with the addition of Cr_3C_2 in the amount of:
  a) 0.3% by weight,
  b) 0.6% by weight,
  c) 0.9% by weight,
  d) 1.2% by weight

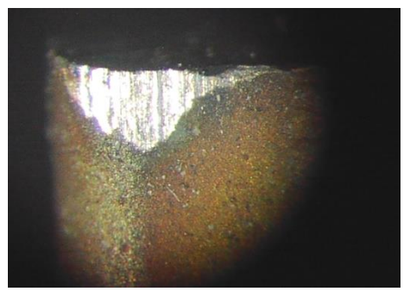
The following processing conditions were used during wear and durability testing:
- cutting speed: v_c = 110 [m/min],
- feed: f = 0.1 [mm/rev],
- cutting depth: a_p = 1.0 [mm],
- processed material: acid-resistant austenitic steel EN 1.4571,



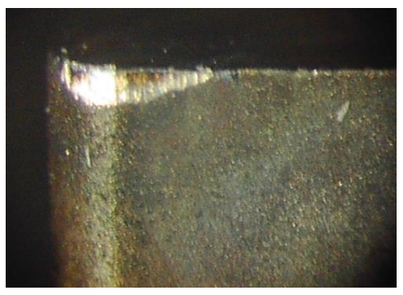
a)
WC-5Co



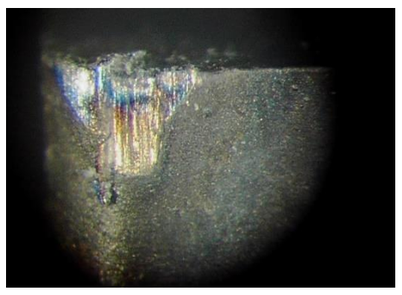
b)
WC-5Co+0.3%Cr_3C_2



c)
WC-5Co+0.6%Cr_3C_2



d)
WC-5Co+0.9%Cr_3C_2



e)
WC-5Co+1.2%Cr_3C_2