

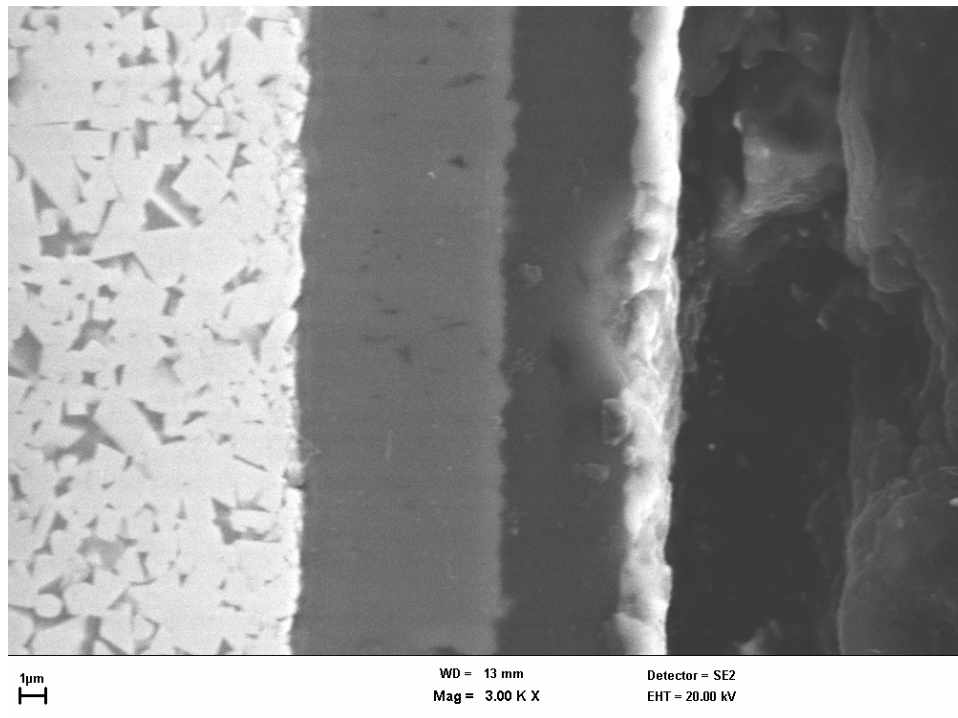


Fig. 5.89: Interface between substrate and coating of a cutting tool insert from supplier 5

When comparing the interfaces between the substrate and the coating of all the five suppliers, significant differences were found. The cutting tool insert from supplier 1 had the roughest interface (see Fig. 5.81) with many protruding grains. The cutting tool insert from supplier 2 had a very straight interface. Co pools could often be found along the interface (see Fig. 5.83). The cutting tool inserts from the other three suppliers 3, 4 and 5, showed an intermediate roughness, with the cutting tool insert from supplier 4 the roughest of the three cutting tool inserts. The cutting tool inserts from suppliers 3 and 5 had similar interface roughness. It seemed that in all the cutting tool inserts, except those from supplier 2, the Co was removed from the surface before depositing the coating.

An additional interesting feature in the cutting tool insert from supplier 1 can be seen in Fig. 5.90 which shows that near the surface of the substrate there is more Co than away from the surface and the grains appear more rounded than in the rest of the substrate. There seemed to be a Co drift towards the interface which

suggests that higher temperatures may have been involved than in the other cutting tool inserts. Note that this coating system does not contain Al_2O_3 , as will be reported later.

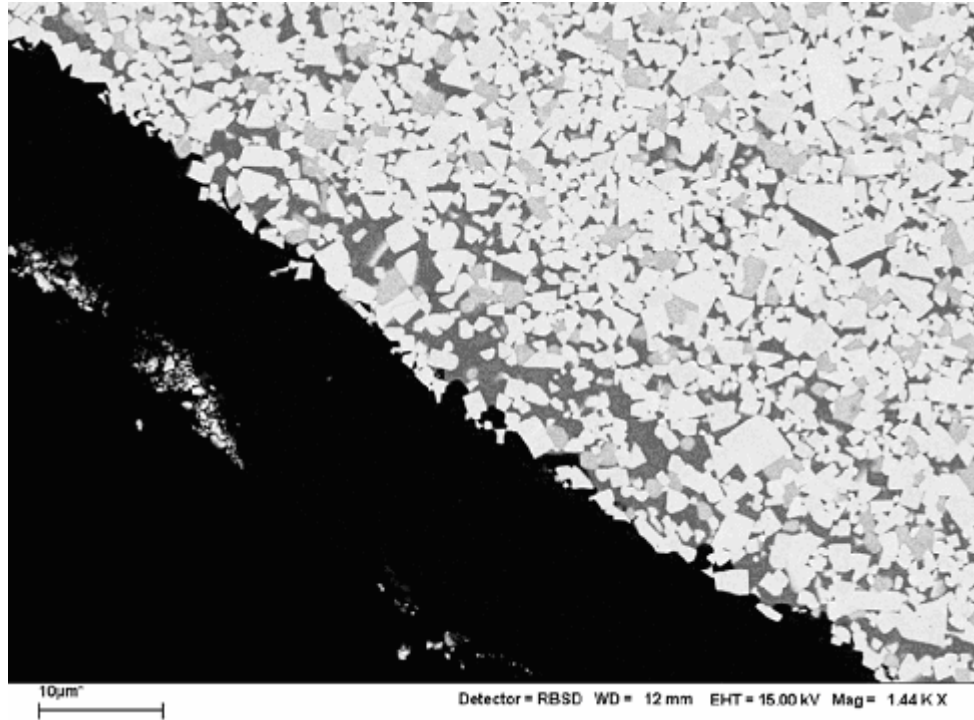


Fig. 5.90: Interface of a cutting tool insert from supplier 1

5.5.3.2 Porosity

Examinations of the coating systems of all cutting tool inserts for porosity showed some porosity almost only in the TiCN layers, which were therefore studied in detail. Representative examples are in Figs. 5.91 to 5.95.

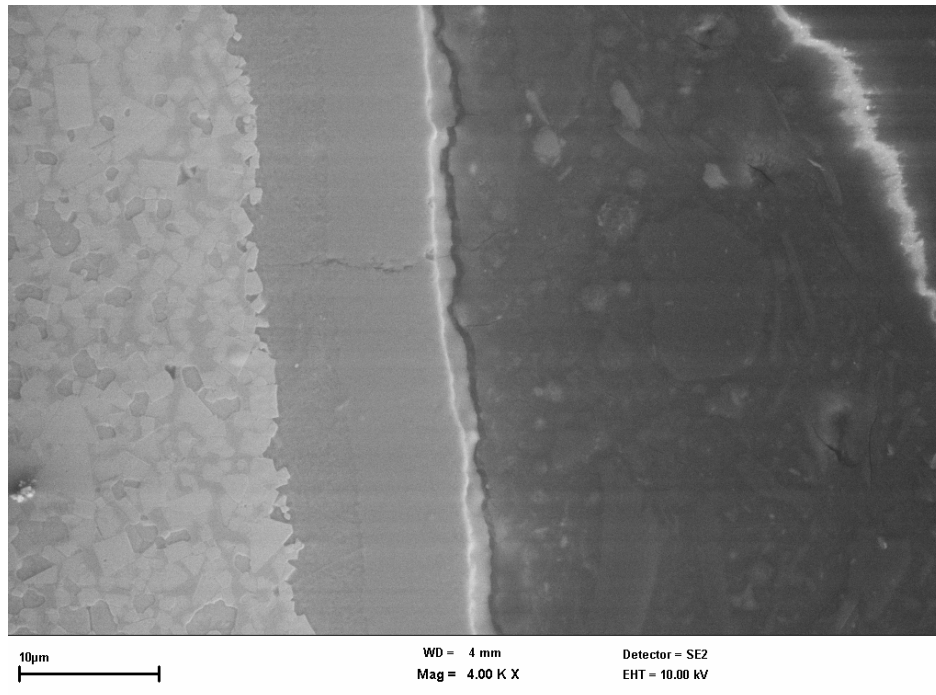


Fig. 5.91: No porosity in the coating of the cutting tool insert from supplier 1

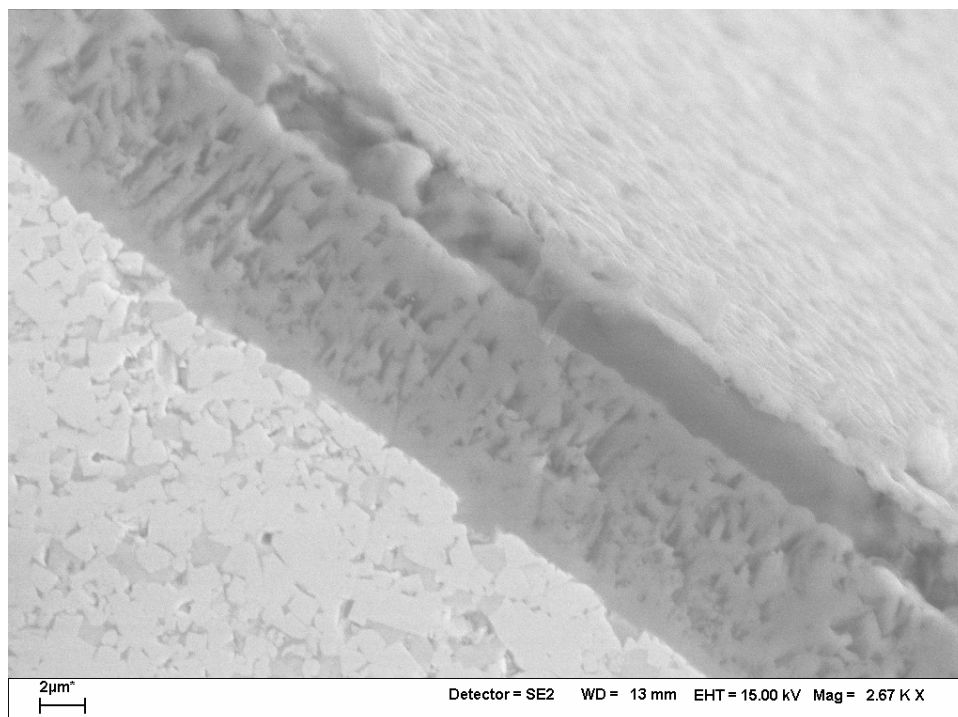


Fig. 5.92: Porosity in the coating of the cutting tool insert from supplier 2

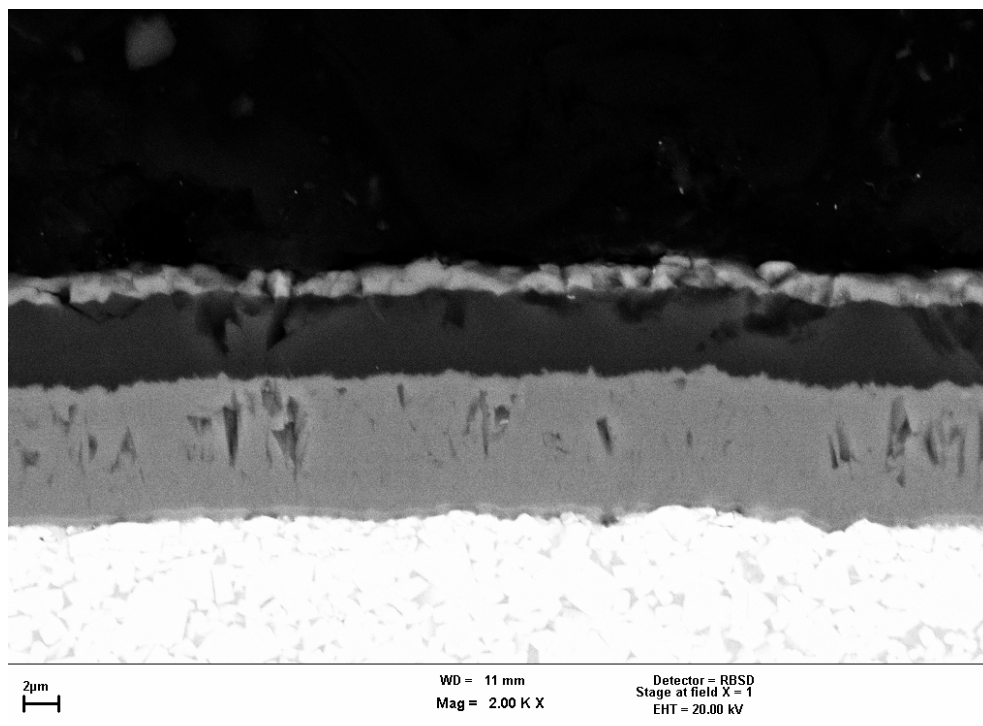


Fig. 5.93: Porosity in the coating of the cutting tool insert from supplier 3

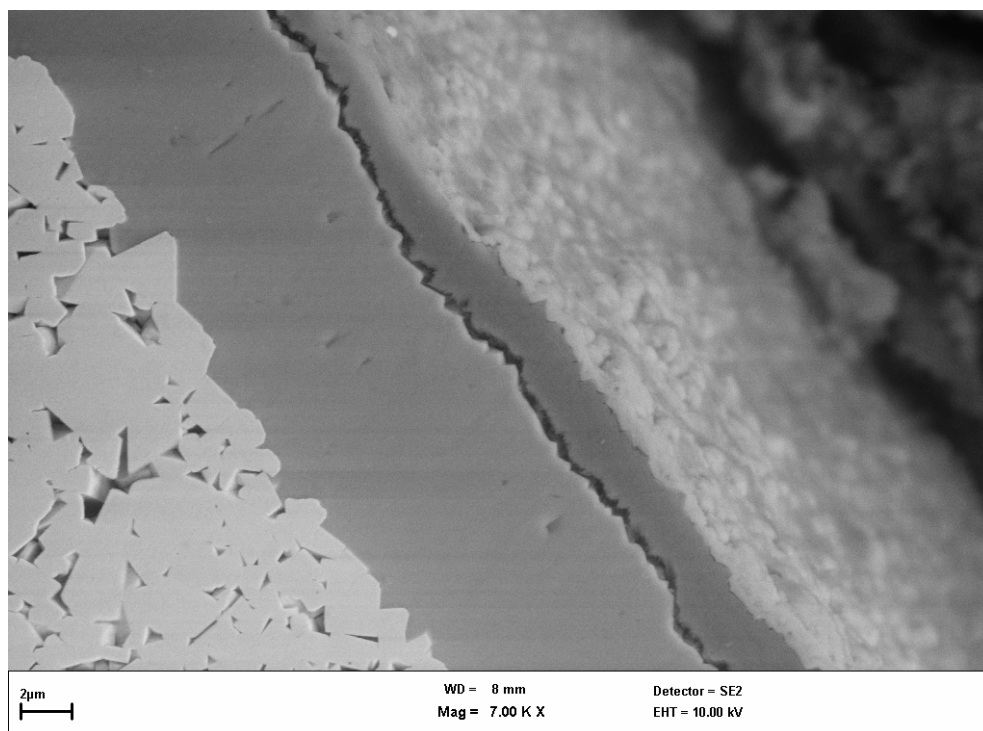


Fig. 5.94: Rare porosity in the coating of the cutting tool insert from supplier 4

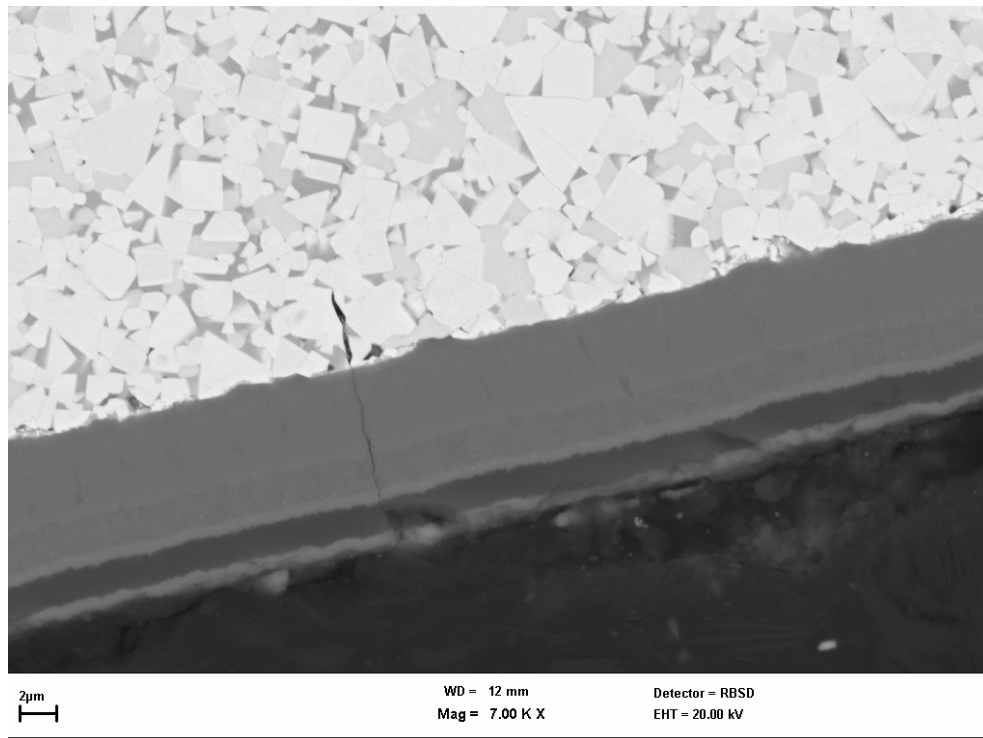


Fig. 5.95: Low porosity in the coating of the cutting tool insert from supplier 5

In the cutting tool inserts from supplier 2, high porosity was observed in the TiCN layer of the coating, while in the cutting tool inserts from suppliers 1 and 4 hardly any porosity was found in the coatings. The porosity in the cutting tool inserts from supplier 3 was intermediate, i.e. it is higher than in the cutting tool inserts from suppliers 1 and 4 but lower than in the cutting tool inserts from supplier 2. The cutting tool insert from supplier 5 showed only little porosity.

5.5.3.3 Cracks

A further feature which was found when examining the coatings of the cutting tool inserts from the five suppliers was cracks. Figures 5.96 to 5.104 show some representative examples of the cracks.