

# SILICON CARBIDE 3C IDENTIFICATION BY THE NEW DEVELOPED NORDIF EBSD EXTRACTION SOFTWARE

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Electron backscatter diffraction (EBSD) is a powerful tool to automatically and quantitatively characterize the orientation of grains and phases of ceramic and composite materials [1]. EBSD ultra-fast pattern acquisition, i.e., patterns streaming to hard disk (HD) and later pattern indexing, becomes an interesting technique to investigate a series of large-scale ceramic, which can quickly provide phase distribution information for further improving ceramic production. However at the same time, it becomes more and more important to handle the huge offline EBSD raw data efficiently and correctly.

In this project, we already reported the EBSD characterisation results of the polymorphs of a solid state sintered silicon carbide component based on Densitac 15, a ready to press powder-made by Saint Gobain Ceramic Materials AS [2]. The pre-sintered powder was produced using the Acheson process and would typically consist of the 4H- and 6H-polytypes, with small amounts of 3C and sometimes traces of 15R. The offline EBSD raw data collection was carried out in a Hitachi SU-6600 FESEM and the patterns were acquired by using NORDIF UF-1100 EBSD detector and written directly to hard disk. The previous results only identified 4H- and 6H-phases in the sample, consistent with the expected transformation of 3C-crystals that takes place at temperatures significantly lower than the sintering temperature of 2110°C. In this abstract further detailed phase identification of silicon carbide 3C by the new developed NORDIF EBSD Extraction Software is carried out.

Figure 1 is the overview for the new developed NORDIF EBSD Extraction Software, where the indexed phase map of the present silicon carbide sample shows partly on the right part of the figure. Offline EBSD indexing reveals that the content of the silicon carbide 3C phase is below 0.5% in the sample. By using the point analysis tool (+) in the program, the individual EBSD patterns from the silicon carbide 3C phase can be retrieved from HD with auto contrast and background subtraction corrections. Representative 3C-SiC EBSD patterns shown in Fig. 2 together with the corresponding internal coordinations (x,y), where the pattern (6,59) is exactly the same retrieved pattern shown that in Fig. 1. Further detailed 3C-SiC pattern indexing is performed. Under the system optimized calibration settings, the best confidence indexes (CIs) in Fig. 2 are all below 0.03, and the representative indexing result shows in Fig. 3. As checking back and comparing that in Fig. 1, it can be concluded that the indexed 0.5% 3C-SiC phases are mostly located at the boundaries among different grains, phases and pores, which resulted those EBSD patterns mis-indexed as 3C-SiC phase.

Offline EBSD together with its Extraction Software is hence an excellent tool to study not only the crystallographic texture and phase distribution, but also fully confirmed that the 3C-SiC recrystallisation and phase transformations processes taking place during sintering of ceramic materials. It also reveals that the present EBSD Extraction Software is good practice to carefully view the offline EBSD raw data before applying further processing algorithms.

[1] Koblischka-Veneva M, Muklich F and Koblischka M R 2002 *Cryst. Engng.* **5** 411-418

[2] Yu, Y.D. et al EMAS 2016, 12th Regional Workshop on Electron Probe Microanalysis Today-Practical Aspects

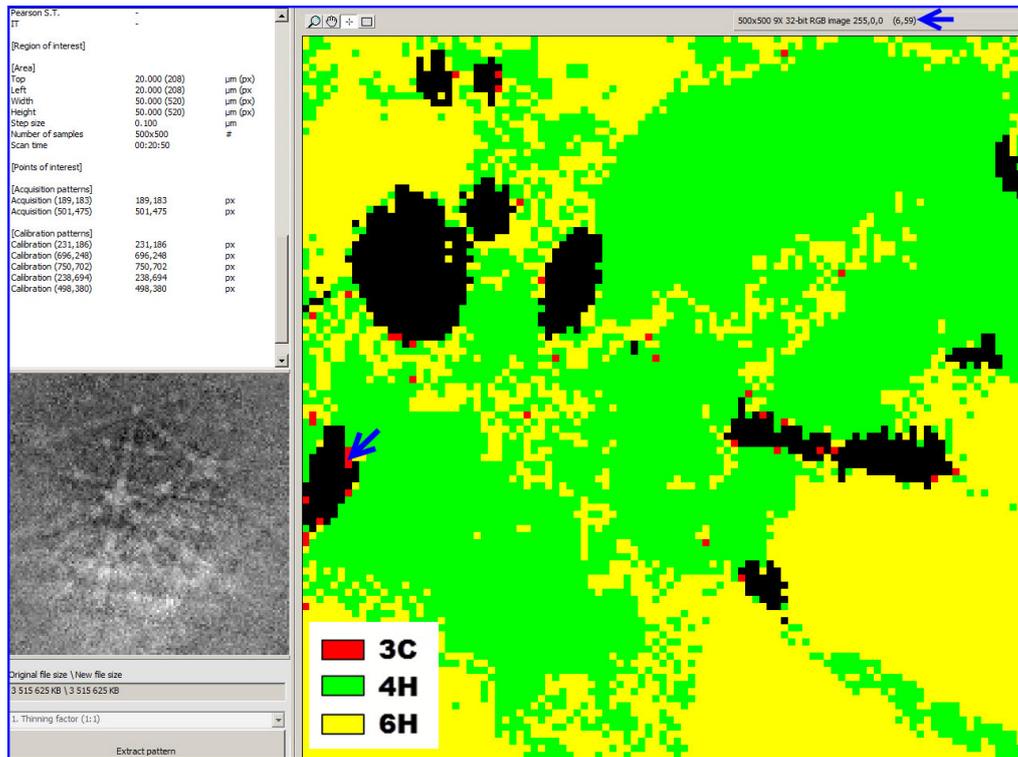


Figure 1. The overview of NORDIF EBSD Extraction Software, and the displayed retrieved 3C-SiC EBSD pattern from the internal coordination (6, 59) are marked by arrows on the enlarged silicon-carbide phase map.

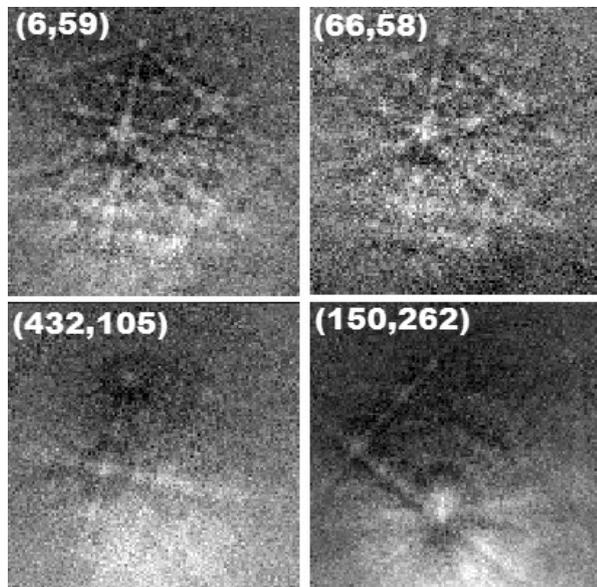


Figure 2. Representative retrieved 3C-SiC EBSD patterns with the corresponding internal coordinations (x,y).

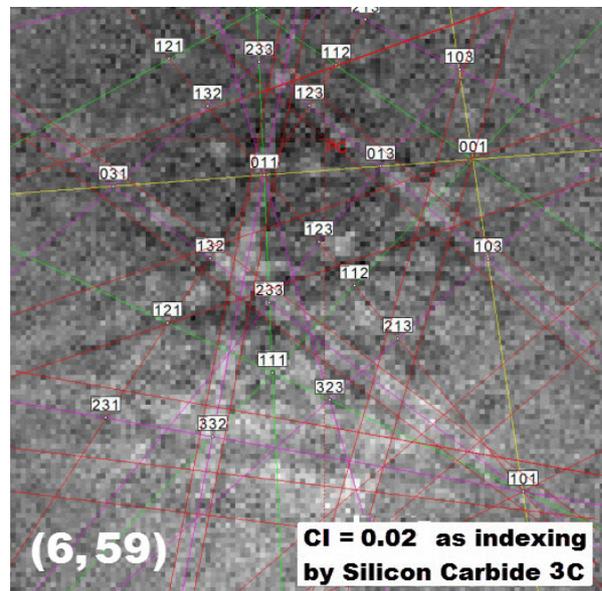


Figure 3. One of 3C-SiC indexing results under the optimized calibration settings.