Composite material made from continuous SiC fibers and SiC-based matrix (SiCf/SiC), designed to be used in the first-wall blanket of a future fusion reactor, was prepared by the infiltration of SiC woven with a suspension containing SiC particles and sintering additives based on X-Si-P-O system (where X stands for Al or Mg). Materials for such an application should have low activation in neutron flux and should be prepared at moderate temperatures due to fiber sensitivity. On the fiber surfaces one or multiple layers of the so called “interphase” layers were deposited. This interphase has three main functions: protection of the fibers, load transfer between matrix and fibers and control of the crack deflection at the interface. Crack deflection, introduced by Vickers indentation, was compared in composite materials with untreated and treated fibers. The fibers were coated with different thin layers of diamond like carbon, CrC, TiC, and others, using magnetron sputtering. In the present work we examined the microstructure of the composite material with an emphasis on the fiber-matrix interfaces. Scanning and transmission electron microscopy and microanalysis were used. High-resolution TEM, Z-contrast imaging (STEM/HAADF) and different techniques of electron diffraction were applied for the phase identification. Chemical composition of individual phases was determined using XEDS and EELS.