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Infiltrated Carbon Fiber Bundles Studied by Combined Scanning Force Techniques

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Due to their mechanical and thermal properties and their low specific weight, carbon fiber felts infiltrated with pyrolytic carbon are suited for a variety of technical applications in the high temperature regime. Therefore, a thorough understanding of the relationship between these properties and the infiltration parameters is of great interest.

A combination of atomic force microscopy including lateral force microscopy (LFM) and force modulation microscopy (FMM) with pulsed force mode (PFM) operation was applied to investigate the surface structure, elasticity, adhesion and lateral forces of infiltrated carbon fiber felts and infiltrated carbon fiber bundles. A clear material contrast between fibers and matrix was observed in LFM as well as in FMM and PFM, and three different microstructures of carbon in the matrix could be distinguished: isotropic (or dark laminar), smooth laminar and rough laminar pyrolytic carbon. AFM also allowed to study the spreading of microcracks in the region of the fiber matrix interface. The AFM results were compared with polarized light micrographs.