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Sommario/riassunto	The results in this dissertation set the ground to answer a fundamental question in data-driven polymer material science: "Why don't prepared composites show less fatigue than the pure plastics?" A simultaneous analysis of mechanical testing and small angle X-Ray scattering from the DESY source in Hamburg has been applied to approach this

question, which is also central to the European research project "Nanotough", and the results are clearly presented in this book. The evolution of the materials structure is visualized and quantitatively analyzed from exhaustive sequences of scattering images. Three different classes of polymer composites are presented as typical and illustrative examples. The obtained results illustrate that the interactions of their components can cause unpredictable structural effects, ultimaltely leading to a weakening of the material, where a reinforcement was expected.