Crack growth detection in short fiber reinforced polymers

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A novel method for crack growth detection based on thermography analysis

The typical S-N curves are indicative of lifetime estimation for components under cyclic loads, as long as there are no existing technical cracks within the component. However, once a technical crack develops within the component, the S-N curves can no longer be used for lifetime estimation, and fracture mechanics models should be employed for this purpose. determine fracture mechanics parameters, it becomes imperative to measure crack growth in specimens subjected to cyclic loading. These tests demand significant time investment and necessitate the continuous monitoring of crack growth over the course of the testing period.

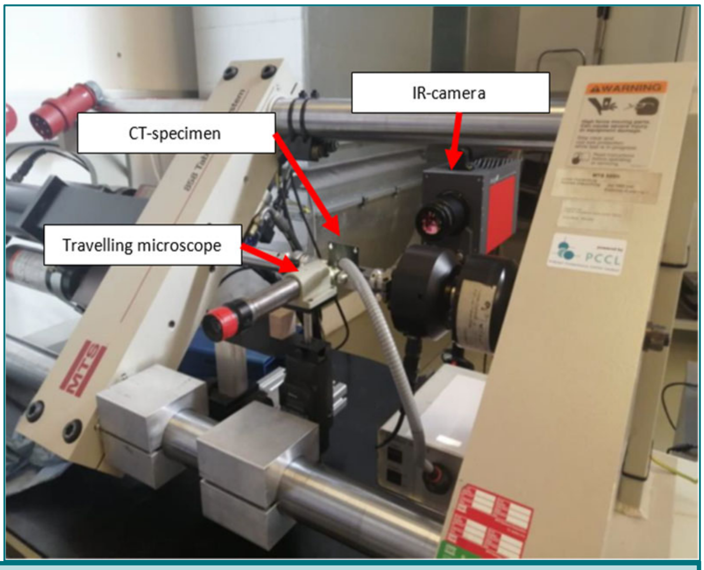
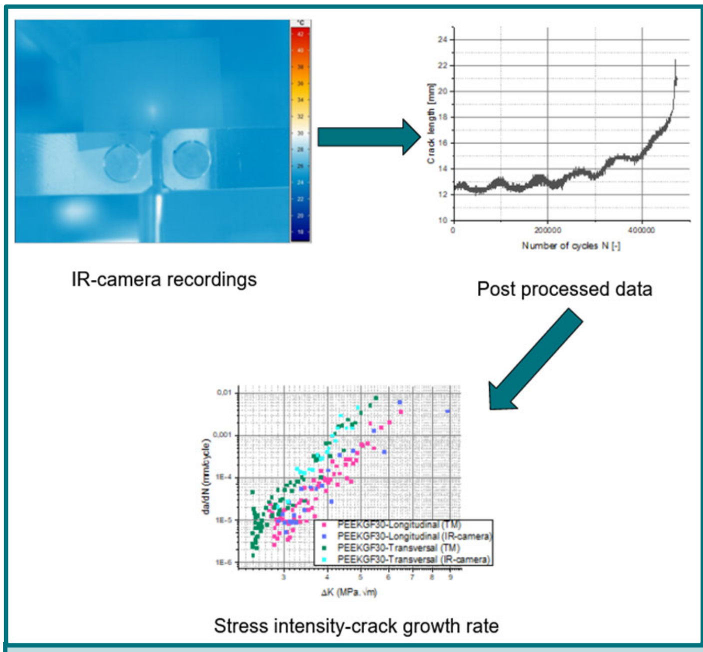


Fig.1

The developed testing setup equipped with an IR-camera for crack growth detection



In an inventive approach, an infrared (IR) camera is employed to monitor the temperature on the rear surface of the compact tension (CT) specimen, according to ISO 15850:220(E). Simultaneously, a traveling microscope (TM) is mounted on the frontal side of the specimen to facilitate manual measurement of crack growth, as illustrated in Fig. 1.

Utilizing a purpose-developed Python code, the specific point demonstrating the highest temperature on the specimen is considered as the crack tip. The method's precision and reproducibility were validated for diverse composites (PPGF30, PPGF40, and PEEKGF30) and in two different finer orientation direction. An overview of the entire process is presented in Fig. 2.

Fig. 2

An overview on the postprocessing flow, from image processing to 'stress intensity-crack growth' curves

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