

# Fatigue crack propagation behavior of materials for terrestrial vehicles

Lotfi Chalbi<sup>1\*</sup>, Amel Samet<sup>1\*</sup>, Latifa Arfaoui<sup>1</sup>, Latifa Arfaoui<sup>1</sup>, Mourad Ben Afia<sup>1</sup>,  
Tarek Lazghab and Amna Znaidi

<sup>1</sup>*Laboratoire de Mécanique Appliquée et Ingénierie (LMAI), ENIT, UTM Tunisie*

*\*[amel.samet@ipieiem.utm.tn](mailto:amel.samet@ipieiem.utm.tn)*

## Résumé pour oral

The fatigue crack propagation behavior of a representative low-alloy steel commonly used in automotive components such as crankshafts, gears, and axles were systematically investigated.

The

selected material, 42CrMo4 steel, features a hardened surface combined with a tough core, providing high torsional strength under service conditions. Mechanical characterization, including

tensile and fracture toughness tests, was conducted to establish the fundamental material properties. Fatigue crack growth experiments were performed under controlled loading conditions in two different environments in order to assess the influence of environmental effects on crack initiation and propagation. The results show that the environment significantly affects crack growth kinetics, particularly during the propagation phase, while the Paris law parameters remain largely unchanged. Fractographic analyses using scanning electron microscopy (SEM) confirmed the dominant fatigue mechanisms and revealed correlations between crack growth behavior and fracture surface features. These findings provide valuable insights into the durability and reliability

of low-alloy steel components for terrestrial vehicle applications under service-relevant conditions.

**KEYWORDS.** 42CrMo4 steel, fracture surfaces (SEM), fatigue, crack growth, lubrication.