IR Thermography of Steel Specimens undergoing Tensile Tests

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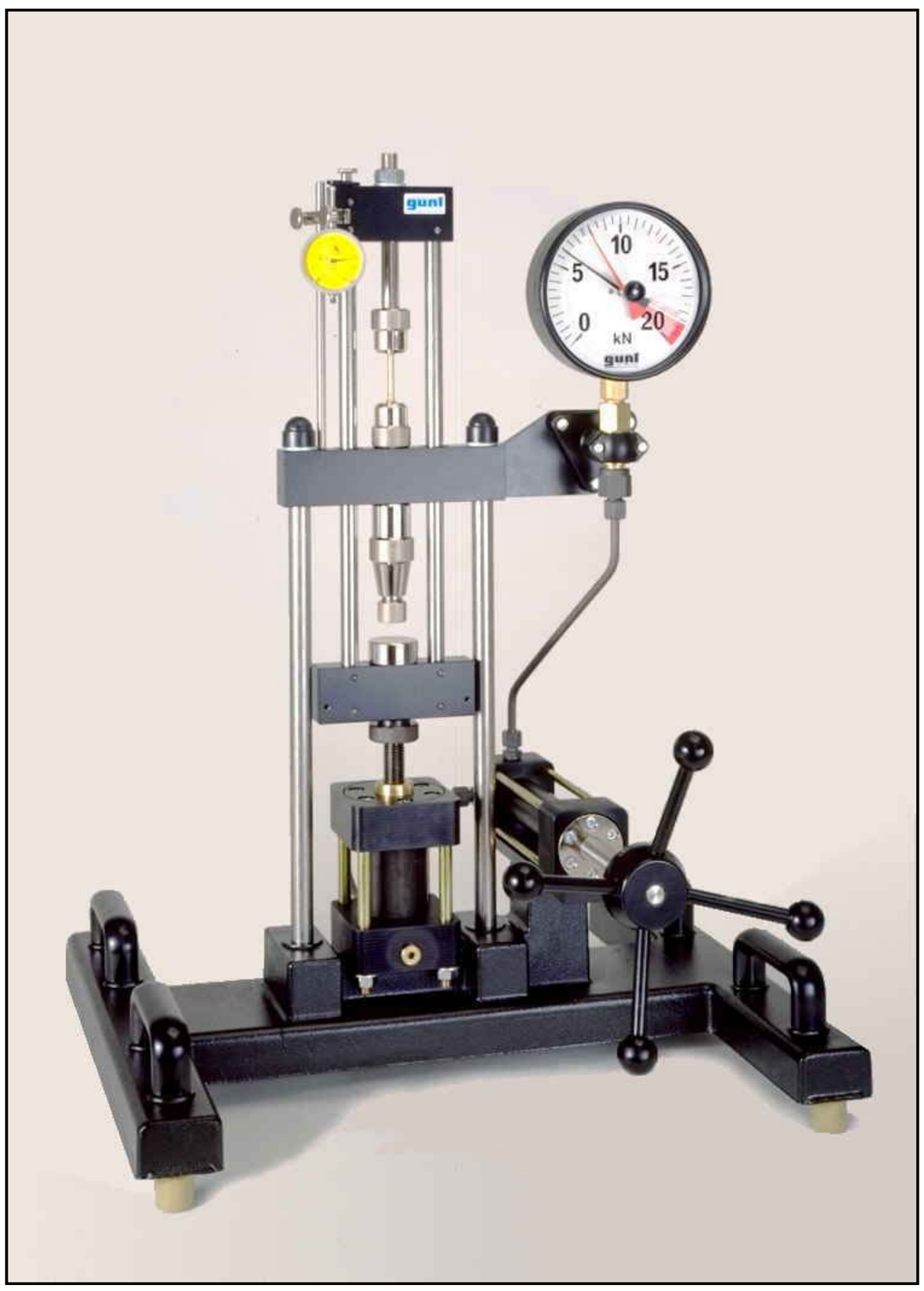
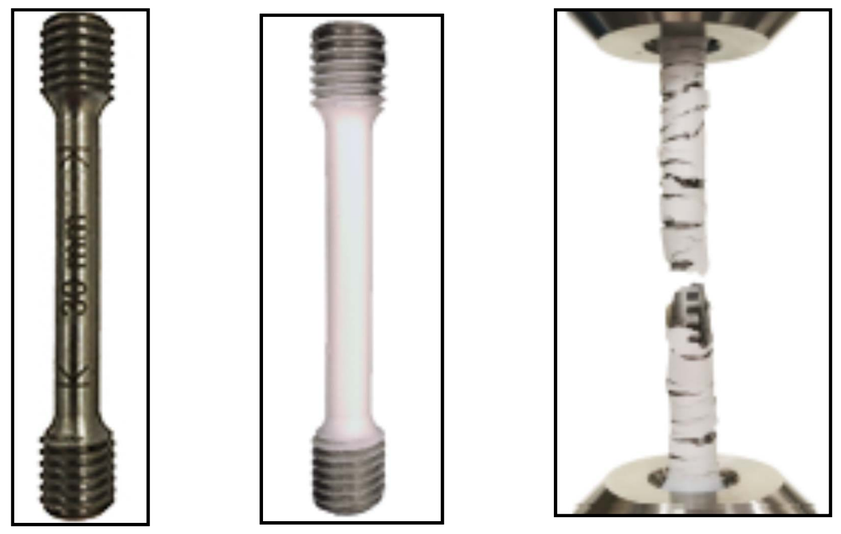
Abstract

In this work, the IR thermography was used to study the steel specimens (DIN 50125 Standard) undergoing the tensile tests. The tensile tests were performed using GUNT® Hamburg Universal Material Tester. The tensile specimens were clamped, and the test force was generated using a hand-operated hydraulic system. A dial gauge measured the elongation of the specimens. Using the WP 300.20 system for data acquisition, the measured values for force and displacement were recorded in a PC. The IR thermographic imaging was performed using the FLIR® T1030sc IR camera and ResearchIR Max software. The steel specimens were coated with high emissivity paint. The tests revealed that the steel specimens show noticeable thermal signature when undergoing tensile loading. The samples were found to be warmer by 20-25 °C at the time of failure. The tests were repeated under various surrounding temperatures such as 25 °C, -5 °C, -10 °C, -15 °C, and -20 °C. The same study was compared with the finite element numerical simulation in ANSYS® Workbench. The experimental and simulation results were found to be in a qualitative agreement.

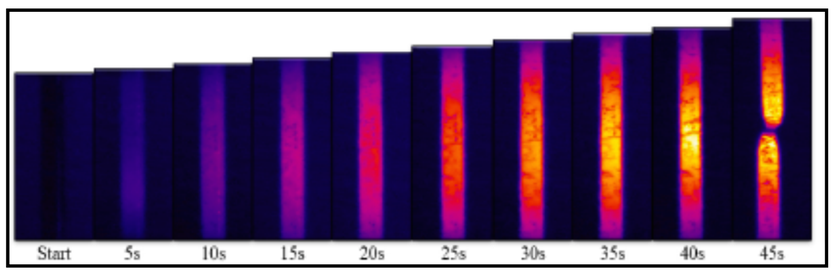
Universal Material Tester (GUNT Hamburg®)



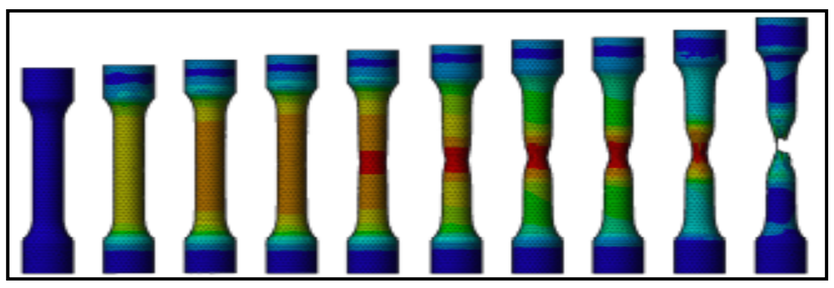
Steel Specimens (coated with high emissivity paint)



Thermography



Finite Element Analysis (ANSYS® Workbench)



Conclusion

IR Thermography has demonstrated that the steel specimen are warmer at the time of failure when undergo tensile loading. The warming of the steel samples are due to the internal friction within the material. Future work is required to quantify the internal friction.

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