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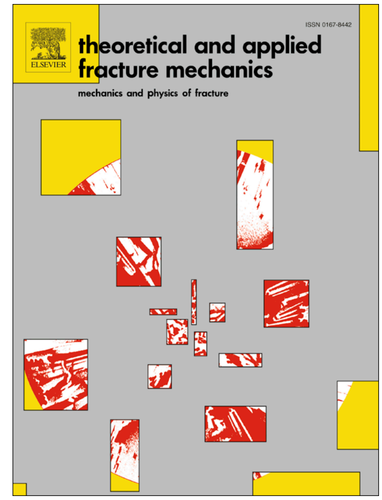

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Surface thermal shock fracture and thermal crack growth behavior of thin plates based on dual-phase-lag heat conduction

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Abstract: This paper studies the thermoelastic problem of a surface cracked plate subjected to a suddenly cooling under the framework of dual-phase-lag heat conduction model. The thermally induced stress intensity factor is calculated based on the linear theory of thermoelasticity. The results demonstrated that the non-Fourier effect is significant in very small time scale which is comparable to the thermal flux lag of the material. The thermal stress intensity factor increases with the thermal flux lag and temperature gradient lag of the material. In addition, the dual-phase-lag heat conduction model predicts a faster cracking behavior than the hyperbolic single-phase-lag heat conduction model and Fourier model in the beginning of thermal shock. It is also found that the crack growth terminates at a critical crack length, which increases with the temperature gradient lag of the material.

Keywords: fracture mechanics, thermal shock, dual-phase-lag heat conduction, non-Fourier effect, stress intensity factor.

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