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Assessing the wrinkling effect in thermoplastic composites under impact loading

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Thermoplastic composites have gained significance due to their superior mechanical properties and recycling potential. However, their mechanical performance, particularly impact resistance, remains insufficiently understood in the context of applications. In this study, thermoplastic composites incorporating polyurethane (TPU) and Kevlar fabric were produced using hot compression moulding, and their performance was evaluated through low-velocity impact tests. A high-speed camera captured the deformation and damage processes of the composites, aided by a mirror positioned behind the objectives to ensure a clear view. During the loading process, an intriguing phenomenon was observed: the wrinkling of the composites, particularly attributed to the soft response of the thermoplastic matrix. These wrinkles emerged due to boundary conditions and pulsed loading. While wrinkle formation can absorb energy through larger deformations, additional damage or failure processes may arise. Understanding the mechanism behind this behaviour is crucial for potential impact applications of thermoplastic composites.

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