The TMSJ Award for Outstanding Original Paper in 2014

The award in 2014 is presented to the authors of the following paper:

Mechanical Characterization of Filaments Based on Rotary Bending Test

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Abstract: In this study, a new experimental device of rotary bending test for filaments was proposed, and the mechanical behaviors of the contact, movement, and release of filaments under rotary bending were investigated. According to the experimental results, the maximum load of a bundle of filaments could be estimated by considering the geometry interaction of filaments. The cumulative energy based on load and rotation angle was calculated, and the correlation between the energy and the number of filaments in the case of various filament diameters and pushing length was estimated. Furthermore, the energy was divided into two energies ($E_I$, $E_{II}$). The energy $E_I$ is dominated by the effect of impact and decomposition, and the energy $E_{II}$ is influenced by the sweeping phenomena. It is obvious that $E_I$ and $E_{II}$ have trade-off relationship due to effects of pushing length. From the results, we believe that the proposed method is useful for design of the products composed of filaments because effects of design parameters of filaments on mechanical characterization can be estimated conveniently.


論文要旨：本研究では，複数本フィラメントの回転曲げ試験を提案し，フィラメントが物体への接触・追従・離脱までの力学的特性の評価を行った．フィラメントの幾何的な相関性を考慮し，フィラメントに伝達される最大荷重の評価を可能とした．また，荷重と回転角度を基に累積エネルギーを計算し，種々のフィラメント直径，押し込み長さの場合のエネルギとフィラメント本数との関係を評価した．さらに，累積エネルギーを領域I，IIのエネルギー$E_I$，$E_{II}$に分割した．エネルギー$E_I$は付着物体への衝突，分離に寄与し，エネルギー$E_{II}$は掃出に寄与する．また，$E_I$，$E_{II}$は押し込み長さによりトレードオフの関係にあることを明確にした．これらの結果より本提案手法は，フィラメントの設計パラメータが力学的特性に及ぼす影響を効率良く評価し得るため，フィラメントを含む製品の設計に有用であると考える．

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