理工学研究所
国際交流・公開研究セミナー

Dr. Luciano Borasi（アメリカ, ノースウェスタン大学）が来日される機会に, レーザー誘起粒子衝突法を利用した材料強度に関するご講演をお願いしました. 是非ご参集ください.

題　目：　Development of Laser-induced Particle Impact Test (LIPIT) and Ultra-high Velocity Deformation Behavior of Engineering Materials.

講演者：　Dr. Luciano Borasi
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日　時：　2025 年　5 月　29 日（ 木 ）　13:30 – 14:30

場　所：　中央大学 後楽園キャンパス　5138 室

アブストラクト:

A comprehensive understanding of material strength across strain rates typically requires the combination of results from different methods, which often vary in loading conditions and/or sampled volumes, leading to discrepancies in material behavior. This study presents a micro indentation approach to measure hardness covering eleven orders of magnitude in strain rate, from quasi-static to phonon drag-dominated rates, on a single material surface under uniform testing conditions. By engineering the geometry of impactors used in laser induced particle impact test (LIPIT), we extended the breadth of accessible strain rates, including multiple distinct rates exceeding 10^5 s^{-1}. This self-consistent approach provides clearer insights into high-rate deformation mechanisms. Our results demonstrate a gradual increase in hardness with strain rate from quasi-static up to ultra-high rates, where a sharp upturn in hardness is observed.

Despite advances in mechanical testing at small scales and testing at high strain rates, studies of mechanical behavior of materials remain largely qualitative in the regimes where these two conditions overlap. Our approach is based on indentation; notably, this work includes some new developments in indentation testing to fill the strain rate gap. In particular, we present a modified “low-rate LIPIT” method made possible by engineering the impactors to extend the range of accessible strain rates down to 10^6 s^{-1}.

This work thus not only bridges gaps in previous datasets but also introduces new clarity into materials behavior under extreme conditions. The results presented here offer a new direction for the calibration of strength models in a quantitatively underexplored range, while also paving the way for further quantitative studies of extreme mechanical behavior and materials design under such conditions.

講演終了後の夕方に懇談会を予定しております.

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米津明生