## Abstract Submitted for the MAR14 Meeting of The American Physical Society

Beating the Heat: Fast Scanning Melts Beta Sheet Crystals<sup>1</sup> PEGGY CEBE, Tufts Univ, XIAO HU, Rowan University, DAVID KAPLAN, Tufts Univ, EVGENY ZHURAVLEV, ANDREAS WURM, DANIELLA ARBEITER, CHRISTOPH SCHICK, University of Rostock — Beta-pleated-sheet crystals are among the most stable of protein secondary structures, and are responsible for the remarkable physical properties of many fibrous proteins, such as silk. Previous thinking was that beta-pleated-sheet crystals in the dry solid state would not melt upon input of heat energy alone. Indeed, at conventional heating rates ( $\sim$ 1-50  $^{\circ}$ C/min), silk exhibits its glass transition (~175  $^{\circ}$ C), followed by cold crystallization, and then by immediate thermal degradation beginning at about 225  $^{\circ}$ C. Here we demonstrate that beta-pleated-sheet crystals can melt directly from the solid state to become random coils, helices, and turns. We use fast scanning chip calorimetry at 2,000 K/s to avoid thermal degradation, and report the first reversible thermal melting of protein beta-pleated-sheet crystals, exemplified by silk fibroin. The similarity between thermal melting behavior of lamellar crystals of synthetic polymers and beta-pleated-sheet crystals is confirmed.

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