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Suppression of molecular vibrations in strained organic semiconductors TAKAYOSHI KUBO, ROGER HUSERMANN, JUNTO TSURUMI, JUNSHI SOEDA, YUGO OKADA, YU YAMASHITA, CHIKAHIKO MITSUI, TOSHIHIRO OKAMOTO, HIROYUKI MATSUI, JUN TAKEYA, Univ of Tokyo, SUSUMU YANAGISAWA, Univ of the Ryukyus, NORIHISA AKAMATSU, ATSUSHI SHISHIDO, Tokyo Tech — The inherent softness of organic semiconductors, which makes them totally suited for flexible applications, also offers us an idea on the modulation of the charge transport in largely strained crystal structure. Here, solution-processed single crystal of 3,11-didecyldinaphto[2,3-*d*:2',3'-*d*']benzo[1,2-*b*:4,5-*b*']dithiophene (C_{10}-DNBDT-NW)[1] is uniaxially and compressively strained for 3% simply by bending the flexible substrate. With this strain, the field-effect mobility increases dramatically from 9.7 cm^2/Vs to 16.5 cm^2/Vs by up to 70%, which is reversible and repeatable for successive bending. Combined with X-ray diffraction and low temperature measurement, a series of calculations based on density functional theory reveal the origin of the enhanced charge transport to be the suppression of the thermal fluctuation of the molecules rather than the slight change of the band structure. Our work shows that compression of the crystal structure directly hinders molecular vibrations and thus leads to the suppression of dynamic disorder, which is a unique mechanism in soft organic semiconductors.

[1]C. Mitsui, **Adv. Mater.** 6, 4546

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