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The role of energy dissipation of the matrix in the synergistic toughening of fiber reinforced soft composites YIWAN HUANG, Graduate School of Life Science, Hokkaido University, Sapporo 001-0021, Japan, DANIEL R. KING, TAO LIN SUN, TAKAYUKI KUROKAWA, JIAN PING GONG, Faculty of Advanced Life Science, Hokkaido University, Sapporo 001-0021, Japan — As a vital class of soft materials, tough hydrogels have shown strong potential as structural biomaterials. These hydrogels alone, however, still possess limited mechanical properties (such as low modulus) when compared to some load-bearing tissues, such as ligaments and tendons. Developing both strong and tough soft materials similar to soft load-bearing tissues is still a challenge. To overcome this obstacle, we have recently introduced a new material design strategy by combining tough hydrogels with woven fiber fabric to create fiber reinforced soft composites (FRSCs). The new FRSCs exhibit extremely high toughness and tensile strength, far surpassing the simple combination of the individual components, indicating a synergistic reinforcement. In this work, we focus on understanding the role of energy dissipation of the soft matrix in the synergistic toughening of FRSCs. By selecting a range of soft matrix materials, from *tough* hydrogels to *weak* hydrogels and even a commercially available *elastomer*, the toughness of the matrix is determined to play a critical role in achieving extremely tough FRSCs. This work provides a good guide towards the *universal* design of extremely tough composites from various soft materials.

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