EML WEBINAR

ZOOM DISCUSSION 271 079 684
YOUTUBE LIVE: HTTPS://TER.PS/EMLYOUTUBELV
WEDNESDAY, 9 DECEMBER 2020
5:00 AM CALIFORNIA, 8:00 AM BOSTON
1:00 PM LONDON, 9:00 PM BEIJING

JIAN PING GONG

HOKKAIDO UNIVERSITY

SELF-GROWING AND STRENGTHENING OF DOUBLE NETWORK HYDROGELS BY MECHANICAL TRAINING

Biological tissues are dynamic, open systems in which structural transformations to adapt to the surrounding environment are constantly occurring through metabolic processes. For example, skeletal muscles hypertrophy and strengthen due to repeated mechanical exercise. The exertion destroys the fibril structure, whereas the nutrition (amino acids) supply and constructive chemical reactions grows new muscle. By contrast, synthetic materials are static, closed systems, with no structural reconstruction and substance exchange with surroundings. Usually, repetitive mechanical loading leads to damage and even failure of materials.

Herein, we present a principle for creating metabolic-like hydrogels that self-grow and strengthen by repetitive mechanical stimuli [Matsuda, et al., Science, 2019]. We show that the double-network hydrogels exhibit sustained strength increase along with size increase under repetitive loading in monomer (nutrition) solution. This metabolic-like phenomenon of double network hydrogels is through a repetitive structural destruction and reconstruction of the brittle network by mechanochemical transduction. This mechanism endows the hydrogels to achieve new functions at specific time and position triggered by mechanical stimuli. This work might inspire new strategies for developing self-adaptable and sustainable materials.

Jian Ping Gong is a distinguished professor of Hokkaido University, Japan. She graduated from Zhejiang University, China, and received Doctor of Engineering at Tokyo Institute of Technology. She joined the faculty at Hokkaido University in 1993. She had been focusing on novel hydrogels with high mechanical performances, including double network hydrogels with high strength and toughness, self-healing hydrogels, low surface friction hydrogels, hydrogels with under water adhesion. Recently, she is focusing on functional hydrogels inspired by biological systems, including self-growing hydrogels, thermal stiffening hydrogels, marine adhesive hydrogels, and memory-forgetting hydrogels. She is also working on the applications of the double network hydrogels as cartilages. She received several awards including Wiley Polymer Science Award (2001), The Award of the Society of Polymer Science, Japan (2006), The Chemical Society of Japan Award (2011), The DSM Materials Sciences Award (2014), the MEXT Commendation for Science and Technology, Japan (2019). Her papers have been cited for 25,545 times with h-index 77 (Google scholar, as of November 24, 2020).

Discussion Leader: Professor **Rong Long**, University of Colorado

Extreme Mechanics Letters (EML) seeks to publish research of immediacy, depth, and originality.