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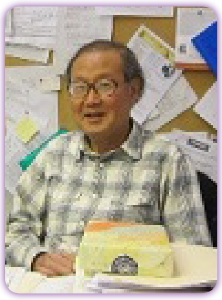

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Design of nanorobotics based on flexible FePd nanohelix for cancer treatment

Recently, we successfully processed the FePd Nano-Robots (NRs) by using electrochemistry route and post annealing process. The actuation mechanism of the proposed FePd NRs is based on two scientific mechanisms associated with ferromagnetic shape memory alloy Fe70Pd30: (1) Hybrid mechanism of chain reaction events; applied magnetic field gradient, magnetic force, stress-induced martensite phase transformation of Fe70Pd30 from stiff austenite to soft martensite, resulting in larger displacement at very high speed that we discovered and (2) magnetic interactions coupled with stress-induced martensite phase transformation under constant magnetic field, resulting in large displacement. This phase transformation of FePd nano-helix is considered different from that of its bulk sized FePd. It is found that the Martensite start temperature (Ms) of the FePd nanomaterial is shifted towards lower temperature as compared with that Ms of the bulk sized FeP and also the FePd nanohelix NR can exhibits nanomotions under applied constant magnetic field. There are many applications we can apply above FePd NRs, one of which is a new treatment of cancers by applying mechanical stress loading on live cancers, inducing Mechanical Stress Induced Cell Death (MSICD) on target cancer cells. We performed a biocompatibility testing on Fe7Pd3 nanoparticles to find that the use of modest amount of the FePd nanoactuators would not be cytotoxic to BT-474 breast cancer cells. Here we report some preliminary results of *in vitro* experiment of MSICD using macroscopic mechanical loading set up which apply mainly dynamic compression loading to live target cells via agarose gel layer. The preliminary results of MSIC indicated that the live breast cancer cells under dominant compressive stress loading area exhibit a mixture of apoptosis and necrosis cell death modes while those under dominant shear stress loading area shows strongly necrosis cell mode.

Biography

Minoru Taya is currently the Director at Center for Intelligent Materials and Systems and also Nabtesco Endowed Chair Professor of Mechanical Engineering in University of Washington. He has completed his BSc in Engineering from University of Tokyo and his MSc and PhD from Theoretical Applied Mechanics from Northwestern University. He is supervising a number of projects related to multifunctional materials and composites with emphasis on sensing and active materials and compact actuators. Most recently, he is working on FePd nanohelix based nanorobotics under NSF-NRI program where the FePd nanohelix can shrink and expand upon switching on and off magnetic field and soft-matter based robotic hand technology using dielectric elastomer. He has published over 330 papers, 5 book chapters in the area of intelligent materials and systems composites and 7 books. In addition, he has published the 3 monograph books.

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