NST-004

Introduction to the Center for Advanced Meta-Materials (파동에너지극한제어연구단 소개)

이학주[1], 김광섭[2], 송경준[2], 정주연[2]

[1]한국기계연구원 파동에너지극한제어연구단, [2]한국기계연구원 나노융합기계연구본부

The Center for Advanced Meta-Materials (CAMM) was launched in 2014 as a center for Global Frontier Projects supported by the Ministry of Science, ICT and Future Planning. The center is geared towards developing core technologies in controlling wave energies by incorporating creative artificial structures of sub-wavelength sizes. Furthermore, the center not only investigates novel meta-materials and devices but also builds new design, fabrication and application platforms in order to realize these technologies. The center will create new markets in various industries such as national defense, housing and medical care. In order to accomplish its goals, CAMM is composed of three major divisions: the fabrication/characterization technologies and application division, the advanced metamaterials for electromagnetic wave division and the advanced metamaterials for mechanical wave division. The center will concentrate its efforts in bringing innovations to conventional technologies in sectors such as machinery, ICT, energy and biomedical technology by adopting the use of advanced metamaterial systems. In this talk, we will introduce principles of advanced wave control and describe some advanced metamaterials which can provide new solutions for various social problems in future.

Keywords: CAMM (Center for Advanced Meta-Materials), platforms (design, fabrication and application)

NST-005

Applications of metamaterials: Cloaking, Photonics, and Energy Harvesting

Kyoungsik Kim

School of Mechanical Engineering, Yonsei University, 50 Yonsei-ro, Seodaemun-gu, Seoul 120-749, Korea

Recently, metamaterials attracted much attention because of the potential applications for superlens, cloaking and high precision sensors. We developed several dielectric metamaterials for enhancing antireflection or light trapping capability in solar energy harvesting devices. Colloidal lithography and electrochemical anodization process were employed to fabricate self-assembed nano- and microscale dielectric metamaterials in a simple and cost-effective manner. We improved broadband light absorption in c-Si, a-Si, and organic semiconductor layer by employing polystyrene (PS) islands integrated Si conical-frustum arrays, resonant PS nanosphere arrays, and diffusive alumina nanowire arrays, respectively. We also demonstrated thin metal coated alumina nanowire array which is utilized as an efficient light-to-heat conversion layer of solar steam generating devices. The scalable design and adaptable fabrication route to our light management nanostructures will be promising in applications of solar energy harvesting system.

On the other hands, broadband invisible cloaks, which continuously work while elastically deforming, are developed using smart metamaterials made of photonic and elastic crystals. A self-adjustable, nearly lossless, and broadband (10-12GHz) smart meatamaterials have great potentials for applications in antenna system and military stealth technology.

Keywords: Metamaterials, Cloaking, Smart meamaterials, Antireflection, Light trapping, Solar energy harvesting