第 10 回研究科セミナー（物質化学フロンティア研究領域）

テーマ

「韓国交通大学校における近年のマテリアルサイエンス分野の研究活動と共同研究への展望」

Recent research activities at Korea National University of Transportation, and scope for research collaboration

講演者：韓国交通大学校 Korea National University of Transportation

教授　Kyung-Min Kim 氏　　助教　Hwan Drew Kim 氏

助教　Jung Min Shin 氏　　教授　Tae kyu An 氏

日　　時：令和 6 年 8 月 26 日（月）13:00～15:00

場　　所：マテリアルサイエンス講義棟　1 階　小ホール

講演要旨：

（1）Fabrication of Hybrid Network Materials Based on Silsesquioxanes（Kyung-Min Kim 氏）

PEI-based network materials with polyhedral oligomeric silsesquioxane (POSS) particles as a cross-linker were prepared by the chemical amine/epoxide reaction of PEI and glycidyl-POSS. Glycidyl-POSS is a hybrid molecule with an inorganic silsesquioxane at the core and organic glycidyl groups attached at the corners of the cage. POSS molecules were homogeneously dispersed as the crosslinking point in PEI matrix. These hybrid network materials were fabricated with not only different weight ratio of POSS to PEI but also 1,4-butanediol diglycidyl ether (BDE) as a cross-linker instead of POSS to confirm the effect of POSS on the CO2 capture performance and thermal stability.

（2）Smart Hydrogels for Tissue Engineering: Harnessing Self-Healing and Vibration Sensing Capabilities（Hwan Drew Kim 氏）

One of the bacterial infections caused by tympanic membrane perforation is otitis media (OM). Middleear inflammation causes continuous pain and can be accompanied by aftereffects such as facialnerve paralysis if repeated chronically. Therefore, it is necessary to develop an artificial tympanicmembrane (TM) that can effectively regenerate the eardrum due to the easy implantation and removalof OM inflammation. In this study, we synthesized hydrogel by mixing gelatin and polyacrylamide. Cefuroxime sodium salt was then incorporated into this hydrogel to both regenerate the TM and treatOM. Cytotoxicity experiments confirmed the biocompatibility of hydrogels equipped with antibiotics,and we conducted drug release and antibacterial experiments to examine continuous drug release. Through experiments, we have verified the excellent biocompatibility, drug release ability, andantibacterial effectiveness of hydrogel. It holds the potential to serve as an effective strategy fortreating OM and regenerating TM as a drug delivery substance.

（3）Repurposed drugs inhibit cancer-derived exosomes for enhanced cancer immunotherapy（Jung Min Shin 氏）

Despite their potent antitumor activity, clinical application of immune checkpoint inhibitors has been significantly limited by their poor response rates (<30%) in cancer patients, primarily due to immunosuppressive tumor microenvironments. Cancer-derived exosomes have recently been demonstrated to exhaust CD8+ cytotoxic T cells as a representative immune escape mechanism. Therefore, repurposed drugs are used to inhibit cancer-derived exosomes for enhanced cancer immunotherapy. Consequently, repurposed drugs effectively reinvigorate exhausted T cells, thereby eliciting robust antitumor effects in combination with anti-PD-1 antibodies. Overall, this therapeutic approach suggests regulating the immunosuppressive environment by inhibiting cancer-derived exosomes, implying its potential to improve the antitumor immune response along with anti-PD-1 antibodies.

（4）Materials Engineering and Device Processing for High-Performance Organic Electronic Devices（Tae kyu An 氏）

Organic electronic materials can be formed onto thin films on various substrates such as plastic films and paper at low temperatures through a solution process. For this reason, flexible devices using organic materials are developed. In this presentation, I will discuss polymeric semiconductor structure design for high solubility and photo-crosslinking system of dielectric polymers, which can enhance the performance of organic electronic devices.

お問合わせ先：教授　松見　紀佳（E-mail: matsumi@jaist.ac.jp）