The collaboration research for the Dual Graduate School between VNU and JAIST

[Title of collaboration research]:

[The members of collaboration research]:

[Reference home-page address]: **http://www.jaist.ac.jp/ms/labs/bunrikinou/terano-www/i_index.html**

[Other references]:

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Nowadays, the development of various novel polymer-based nanocomposites with new properties has become one of the key research targets in the field of polymer and material science from both academic and industrial points of view. One of the most popular procedures of synthesizing polymer-based nanocomposites is to disperse nano-sized particles of various inorganic materials into a certain polymer matrix by different methods. Although a great number of polymer-based nanocomposites had been successfully synthesized up to now, a deeply mechanistic understanding of the physico-chemical interactions between the inorganic nano-particles and the polymer matrix has been far from being achieved. In this project, a basic exploration of the physico-chemical interactions between inorganic nano-particles and polymer matrix will be addressed aiming at much clearer elucidation of structure-properties relationship and at a future state-of-the-art designing of polymer-based nanocomposites. The main interest is mainly focusing on the most commonly used polyolefin-based nano-materials. As for polyolefin-based materials, it has been frequently reported that the mechanical and thermal properties as well as many other performances including transparency, fire retardancy, and gas permeability, could be significantly improved for polyolefin-based nanocomposites compared with the original polyolefin materials. Within most of these previous studies, clay was the main type of inorganic nano-fillers used. As the clay is anisotropic particles, it makes the interaction between the nano-particles and polyolefin matrix most complicated, which is not suitable for our basic mechanistic investigation. The isotropic spherical nano-particles of silica gel (SiO_2) were selected for preparation of target nanocomposites based on one of the most important polyolefins: polypropylene (PP). As a matter of fact, the use of SiO_2 was seldom reported in the literature. Moreover, the correlation of the structure and mechanical properties of the nanocomposites in terms of size, content, surface hydrophilicity and dispersion state of nanoparticles, and the affinity of the polymer matrix with the nanoparticles is still not established. In this research project, the following topics will be explored.

1) The effects of size, content and surface nature of various silica nanoparticles on the morphological , mechanical and thermal properties polypropylene/Silica nanocomposites will be investigated.
2) The photo- and thermal oxidative degradation behavior of polypropylene/Silica nanocomposites in terms of effects of size, content and surface nature of various silica nanoparticles will be investigated.
3) Functionalization of polypropylene/Silica nanocomposites through functionaliztion of the silica nanoparticle surface using various chemical reagents will be explored.