fabrication of conducting polymer nanocomposites via the Pickering emulsion polymerization process has attracted a lot of attention recently. One of their excellent applications is an electrorheological (ER) fluid, which is a special type of smart suspension with controllable fluidity under an electric field. In this presentation, we introduce several ER responsive core–shell structured particles synthesized by the Pickering emulsion method and their ER characteristics but mainly focusing on polymeric particle emulsifier.

INTRODUCTION
Electrorheological (ER) fluids as smart complex fluids are generally composed of conducting and/or dielectric particles dispersed in an insulating liquid medium, whose properties change reversibly and drastically from a fluid-like to solid-like state by the application of an electric field. As electro-responsive particles, several core-shell structured smart composite particles were fabricated by Pickering emulsion polymerization and then applied for ER fluids.

Pickering emulsion polymerization has been known to be a feasible way of preparing inorganic/polymer composite nanoparticles without an organic surfactant or stabilizer to prevent the droplets from coalescence and agglomeration.
in silicone oil and their ER performances were investigated by a rotational rheometer test in the presence of applied electric fields. Their smart characteristics of rheological properties including flow curve with shear stress, yield stress, dynamic modulus and dielectric spectra were observed to show typical ER behaviours.

As for core-shell structured PANI/PDVMA particles, they were fabricated through Pickering emulsion polymerization, using PDVMA particles as a solid surfactant. The synthesized PANI/PDVMA particles were adopted as an ER material suspended in silicone oil (particle concentration: 10 vol %).

RESULTS AND DISCUSSION

Figure 1 represents the shear stress of the PANI/PDVMA particle-based ER fluid at various electrical field strengths. The ER fluid exhibited a Newtonian fluid-like behaviour in the absence of an input electrical field. However, when the electric field strength was applied, ER fluid shows a significant increase in shear stress. The shear stresses increased with increasing electric field strengths. The solid lines following the trend of the flow curves precisely were generated from a flow curve equation known as Cho-Choi-Jhon (CCJ) model, which has been widely adopted to investigate the shear stress behaviours by fitting the curves with six parameters for both ER and MR fluids.

\[
\tau = \frac{\tau_0}{1 + (\tau_1\dot{\gamma})^\alpha} + \eta_\infty \left(1 + \frac{1}{(\tau_2\dot{\gamma})^\beta}\right) \dot{\gamma}
\]

where \(\tau\) represents a yield stress; \(\tau_1\) and \(\tau_2\) are time constants; \(\alpha\) and \(\beta\) are associated to the transition of the shear stress in a low and a high shear rate region, respectively; and \(\eta_\infty\) represent the viscosity at infinite shear rate.

In addition, viscoelastic and dielectric properties were examined along with their material characteristics.

REFERENCES