# Advanced Durable Materials for Severe Environment

**- New Type metal Matrix Composite Materials -**

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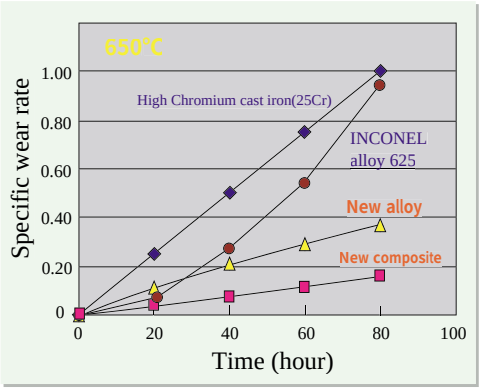
The material innovation is one of the key-technologies to operate the thermal power plant and the advanced waste treatment plant at higher temperatures for increasing the thermal efficiency, and for decreasing the environmental injurant such as dioxins.

We have found that the new type composite materials (Fe-Cr-Ni-MX-C) have excellent durability at high temperatures in comparison with conventional alloys. Now the demonstration experiment of the materials developed in our laboratory is carried out in a commercial coal burning power plant and in an advanced waste treatment plant.




Specific wear rates of the newly developed alloy and the composite reinforced with alumina short fibers

# Development of a Method to Determine Polymer Density

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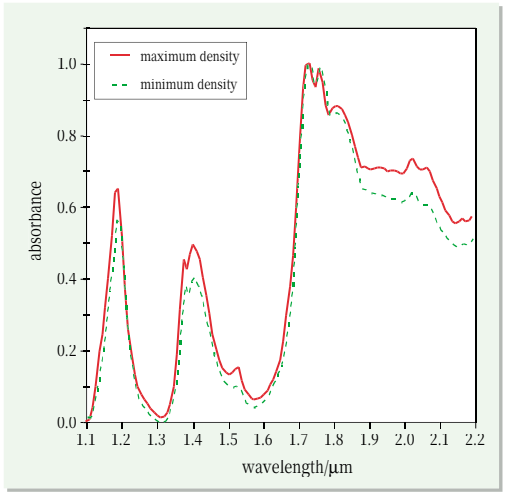
A rapid and intact method has been developed for predicting polyethylene density by near-infrared spectroscopy combined with neural network analysis. Near-infrared spectra in the 1.1-2.2 μm wavelength region have been measured for pellets or powders of twenty-three kinds of polyethylene with different densities (0.898-0.962 g/cm$^3$). The spectra were trained for back-propagation neural network after normalized and second-derivative treatments to predict polyethylene density. Although only a small number of spectral data were used for training, a leave-one-out test of neural network analysis has demonstrated good result, with a root mean square error of prediction of 0.0003. It is found that near-infrared spectroscopy combined with neural network analysis is useful for recycling plastics efficiently and accurately.




Near-infrared spectra of high density (red) and low density (green) polyethylene samples