# Surface modification of P25 using low temperature facile synthesis method via microwave irradiation

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One of the most commonly used metal oxide for photocatalytic applications is $TiO_2$ due to its non-toxicity, low cost, high stability, and low chemical corrosion compared to other metal oxides. This $TiO_2$ applies to environmental purification, photovoltaic cells and water splitting. However, the limitation of $TiO_2$ is its wide bandgap of 3.0-3.2eV which can only be activated by ultraviolet light ($\lambda$<380nm). In order to overcome these drawbacks, extensive researches have been carried out to improve photocatalytic activity of $TiO_2$ in wide range of irradiation.

In this study, we introduce a simple, inexpensive, and low temperature modified method of commercial P25 powder by using hydrogen peroxide in a microwave oven to expand those conventional limited applications. The characteristics of original P25 and modified P25 (MP25) powders were analyzed by Raman, XRD, XPS, TEM, PL and UV-Vis reflectance.

Surface properties and surface defects were identified from these measurements. After modification, the XRD pattern indicates higher intensity compared to P25 that means improved crystallinity of MP25. In the Raman spectra, the mode of MP25 at $282 cm^{-1}$ corresponded to Ti-OH that can react with photogenerated holes and it leads to formation of hydroxyl radicals to destroy contaminants. In the XPS study of MP25, Ti 2p spectra shows $Ti^{3+}$ peaks and O1s spectra shows $O_2^-$ peak as oxygen vacancy and OH peak as the adsorbed peak on Ti metal. The $Ti^{3+}$ and OH groups on the surface of MP25 play an important role as well as $TiO_2$ doped metal atom.

Photocatalytic performances of MP25 were evaluated by decomposition of R6G solution under Solar (1Sun, $100 mWcm^{-2}$, AM1.5G) and UV irradiation (312nm 6W) (Fig.1). From these results, the MP25 showed photocatalytic performance twice as good as that of P25. The photocatalytic efficiency enhancement of MP25 is related to surface defect formation such as $Ti^{3+}$ and Ti-OH, various sized distribution of anatase/rutile, and re-aggregation.

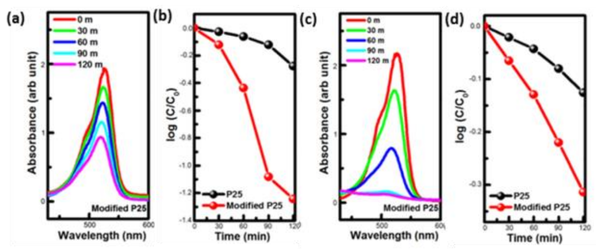


Fig.1 Photocatalytic study of P25 and MP25, UV-Vis absorption spectra of R6G solution after irradiation with 1 Sun ($100 mWcm^{-2}$, AM 1.5G) using (a) MP25 and (b) Sun light driven photocatalytic degradation kinetics of P25 and MP25. Photocatalytic study of P25 and MP25, UV-Vis absorption spectra of R6G solution after irradiation with UV light (312nm at 6W) using (c) MP25 and (d) Sun light driven photocatalytic degradation kinetics of P25 and MP25.

## REFERENCES

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