TiO$_2$ nanotubes are biocompatible and many studies have been carried out for their biotechnological applications, especially in relation to drug carriers. The purpose of this study is to apply TiO$_2$ film on the variety of metal substrates that could be used as biomaterials, and by forming various depth of nanotubes on the films, biocompatibility of the TiO$_2$ nanotube and its ability as a carrier is applied to variety of materials according to various purposes. In this work, we present the fabrication of self-organized TiO$_2$ nanotubes layer that was grown from flat and thin sputter-deposited titanium (Ti) films on Si (100) wafer.

For the first step, titanium layer was coated on Si wafer using magnetron sputtering. The substrates were covered with an insulative spray on the back side against input current interference. Second step, plasma electrolytic oxidation (PEO) was performed for TiO$_2$ nanotube fabrication on outer sputtered Ti layer.

TiO$_2$ nanotubes were grown by plasma electrolytic oxidation (PEO) which potential was kept at 20 V of these substrates in 0.5 wt% hydrofluoric (HF) acid at different oxidation time between 5 and 20 minute resulting in TiO$_2$ nanotubes with length ranging from about 200 to 400 nm, which was confirmed with cross-sectional view of field emission scanning electron microscopy. The key to achieve self-organized, time-dependent growth TiO$_2$ nanotubes layer from the thin film on Si substrate is to operate at low temperature.

Hence from this study, it was shown that the TiO$_2$ nanotube was able to be formed on different substrate such as Si wafer in this case, and such TiO$_2$ nanotube will improve the biocompatibility of substrate other biomaterials. Also length of TiO$_2$ nanotubes was able to be controlled by oxidation time. Such results would be useful in designing variety of biomaterials that is used for drug loading and delivery.