Composite material for electrodes: TOYAL-TITAN®

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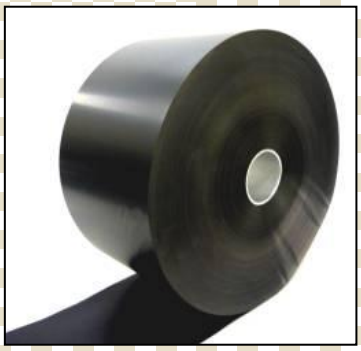

TOYAL-TITAN®

【 1. What is TOYAL-TITAN®? 】

Toyo Aluminium has discovered unique technology to generate aluminium carbide (Al_4C_3) by heating aluminium foil to a high temperature in a hydrocarbon atmosphere. This phenomenon has been utilized in the "TOYAL-CARBO®" and "TOYAL-TITAN®" composite materials for electrodes, which have various particles fixed onto the surface of aluminium foil by Al_4C_3.

As shown in Figure 1, on "TOYAL-TITAN®", titanium oxide fine particles are fixed onto the surface of aluminium foil. This structure means that the foil has numerous attractive features that are not possible on etched aluminium foil. For example, standard specification products have an extremely high capacitance of 4,000 μF/cm^2 and high hydration resistance.

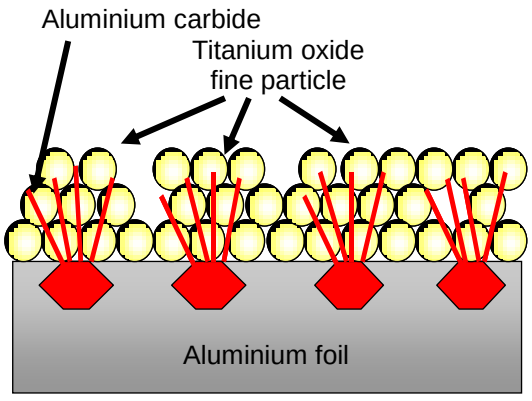

Fig. 1 Schematic diagram of TOYAL-TITAN®

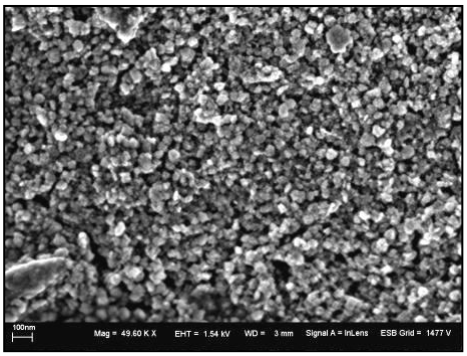

Fig. 2 Secondary electron micrograph of surface of TOYAL-TITAN®

【 2. Manufacturing method 】

Figure 3 shows the manufacturing processes for TOYAL-TITAN®. The surface of 30 μm thick aluminium foil is coated on both sides with titanium oxide fine particles to a thickness of 2.5 μm on each side. The foil is then placed in a hydrocarbon atmosphere and kept at a temperature of 873 K or greater. This results in the generation of Al_4C_3 and titanium oxide particles are fixed on the surface of the aluminium.

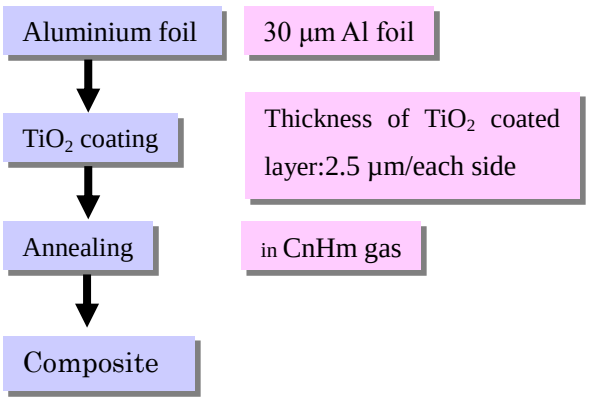

Fig. 3 The manufacturing processes for TOYAL-TITAN®

【 3. Features 】

(1) Capacitance

As shown in Figure 4, it is possible to control the value of the capacitance by varying the thickness of the layer of titanium oxide that is fixed. It is possible to obtain values more than 10 times greater than on conventional high capacitance etched aluminium foil for cathode.

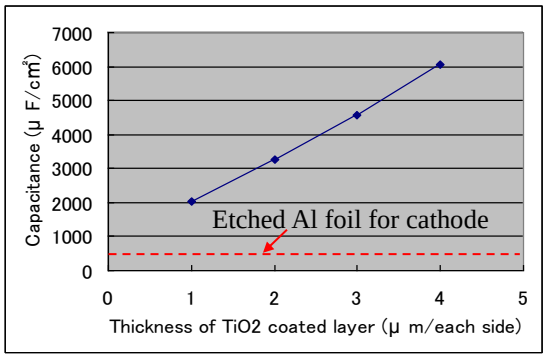

Fig. 4 Relationship between thickness of TiO_2 particle layer and value of Capacitance

(2) Hydration resistance tests

When etched aluminium foil is boiled in pure water at 100°C, the growth of a hydrated film greatly reduces the value of the capacitance. However, on TOYAL-TITAN®, there are particles of the highly stable titanium oxide fixed at high density to the surface of aluminium foil, so there is hardly any drop in capacitance and the high level is maintained. This can be seen from the results in Figure 5.

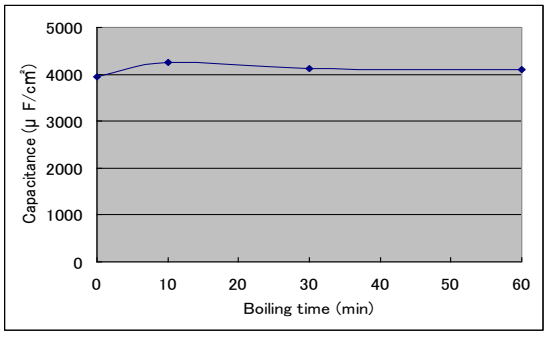

Fig. 5 Results of hydration resistance tests (Variation in the capacitance when boiled in pure water at 100°C)

【 4. Applications 】

TOYAL-TITAN® is a composite material that has both extremely high capacitance and stability. The possible applications for it include the following.

◆ Cathodes on liquid aluminium electrolytic capacitors

In low voltage capacitors in particular, simply using a cathode made from TOYAL-TITAN® in place of an etched aluminium foil one can make the capacitance of the capacitor overall a maximum of 1.5 times larger.

Furthermore, as shown in Figure 6, when producing a capacitor rated 6.3 V 1,500 μF, it is possible to make the capacitor itself more compact (with a 40% reduction in volume) and the anode foil used is reduced by around 30%. It is therefore possible to reduce costs for the capacitor overall because the components and materials used are reduced.

◆ Cathodes on conductive polymer aluminium solid electrolytic capacitors

TOYAL-TITAN® is particularly suitable for high voltage products and products for which high reliability (long life) is demanded.

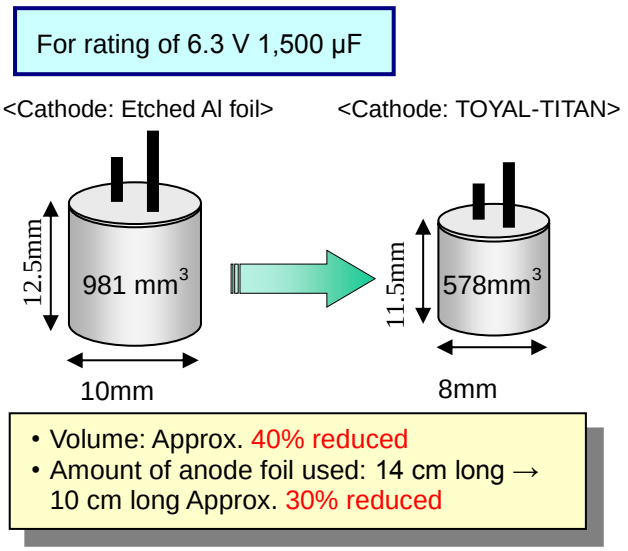

Fig. 6 Example of reduction in size of liquid aluminium electrolytic capacitors through use of TOYAL-TITAN®