Titanium Oxide Solidified Body Absorbs and Stably Confines a Large Amount of Cesium

NIMS successfully created a new material being capable of absorbing high concentrations of cesium and stably confining the absorbed one for a long time.
Cesium 137: Radioisotope of cesium, around 30 years as its half-life, radiation emission, and high chance of suffering from cancer when it enters the body.

1) Titanium Oxide Solidified Body
A titanium dioxide was used as a solidified body to absorb cesium.
A molten molybedenum oxide containing titanium oxide and cesium, which have been dissolved thereinto, was electrolyzed. The result showed that the titanium oxide solidified body absorbed high concentrations of cesium.

2) Confining of Absorbed Cesium by Titanium Oxide Solidified Body
The fact that the titanium oxide solidified body is capable of stably confining cesium therewithin for a long time was founded, and was experimentally confirmed.
A variation of cesium eluted from the titanium oxide solidified body with respect to time is graphically shown in Fig. 2. As seen from the graph, the elution rate of cesium from the titanium oxide solidified body (red curve) sharply falls with respect to time, while that of cesium from the conventional borosilicate-glass solidified body gently falls.
Confining effect of the titanium oxide solidified body was evaluated
in a hydrothermal condition (closed system and at 150℃).
A test piece of the solidified body was placed in a hydrothermal condition (closed system and at 150℃).
As seen from the graph, at a time point where one week elapsed from exposure of the test piece in the hydrothermal condition, the elusion rate of the cesium when it elutes from the titanium oxide solidified body is 1/170 of that of the borosilicate glass of the solidified body.
The titanium oxide solidified body absorbed cesium of 1 g per 1 cm3 (solidified body). The used titanium oxide solidified body: Mono crystalline in shape, 20 ｕm thick and 5,000 ｕm long.
The titanium oxide of 1 cm3 is capable of absorbing the amount of cesium contained in a cesium aqueous solution of 100 tons, which contains 10 ppb of cesium, and stably confining the same therein. The titanium oxide solidified body is throughout prepared under normal pressure.

Fig. 1 Titanium oxide by electron microscope

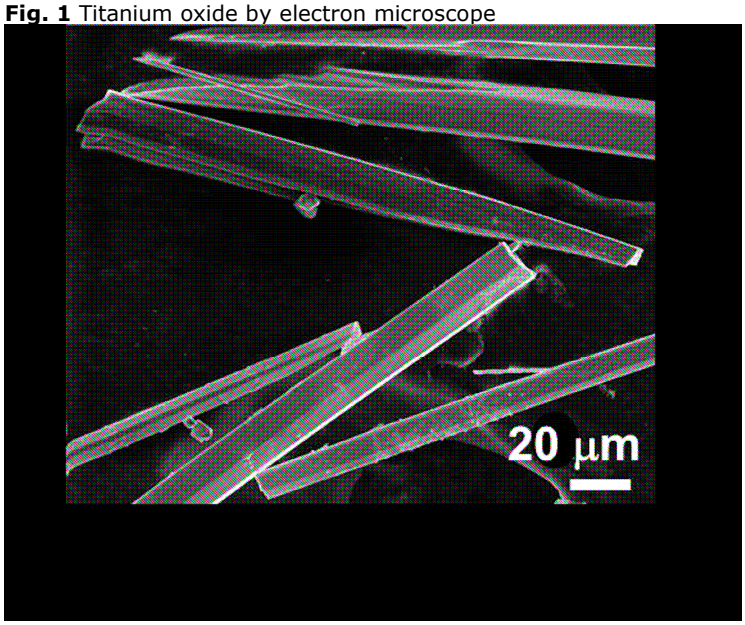
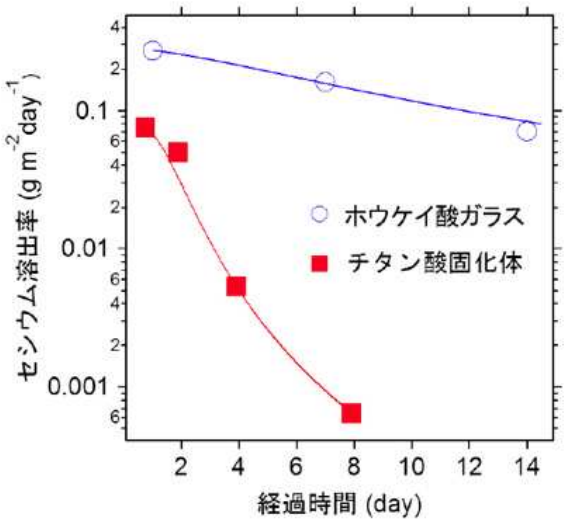


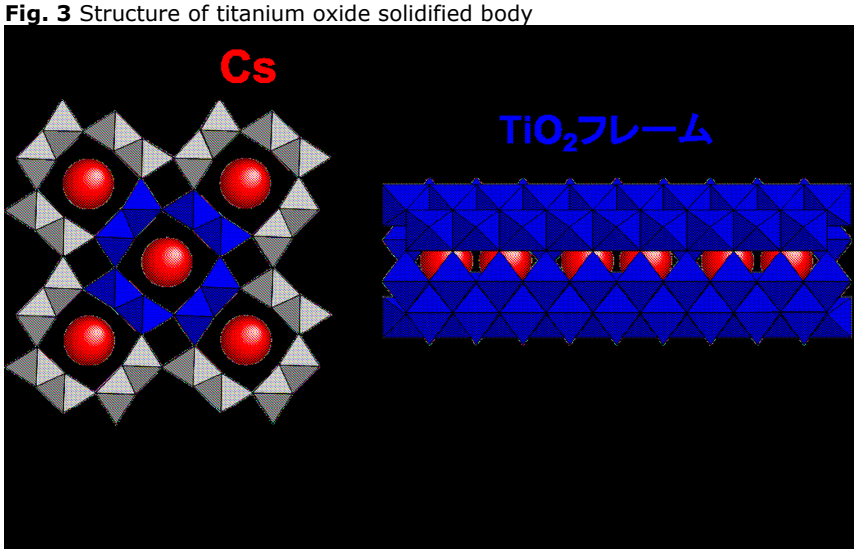
Fig. 2 Elution rate of cesium out of titanium oxide solidified body



セシウムの溶出率 = Cesium elution rate
経過時間 = Time
ホウケイ酸ガラス = Borosilicate glass
チタン酸固化体 = Titanium oxide solidified body

Structure of Titanium Oxide Solidified Body
As shown in Fig. 3, within titanium oxide monocrystalline, cesium ions are linearly and densely arrayed along its axis. With the structure, cesium elutes from both ends of the needle-shaped monocrystalline. The area of each end is extremely small, so that it allows little amount of cesium to elude from the monocrystalline.

Fig. 3 Structure of titanium oxide solidified body



TiO2 フレーム = TiO2 frame

Source: NIMS (National Institute for Materials Science)
http://www.nims.go.jp/news/press/2011/05/p201105180.html