



ICESD 2014: February 19-21, Singapore

Recovery of Tantalum Sintered Compact from Used Tantalum Condenser Using Steam Gasification with Sodium Hydroxide

Shigeyuki Katano^{a,*}, Takaaki Wajima^a and Hideki Nakagome^a

^aGraduate School of Engineering, Chiba University, 1-33, Yayoi, Inage, Chiba, 236-8522, Japan

Abstract

Recovery of tantalum resource from used tantalum capacitor in electric equipment is important because the production of tantalum have not been stable for the price and the quantity. However, recovery of tantalum sintered compact from tantalum capacitor is difficult since the compact strongly covered with the flame retardant resin made of halogenated compounds (mold resin). In this study, steam gasification with sodium hydroxide was applied for recovery of tantalum sintered compact by destroying mold resin and stabilization of halogenated compounds in sodium hydroxide to prevent exhausting halogenated gas. Mold resin can be decomposed by steam gasification with NaOH to recover the sintered compact of tantalum. Furthermore, most halogen gas generated from decomposition of mold resin can be trapped in sodium hydroxide not to exhaust halogen gas. These results suggested that recovery process of tantalum sintered compact from the used condenser using steam gasification with sodium hydroxide is expected as a feasible way to recycle the rare metal in electric equipment.

© 2014 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/3.0/>).

Selection and peer review under responsibility of Asia-Pacific Chemical, Biological & Environmental Engineering Society

Keywords: Tantalum recovery, mold resin, steam gasification, sodium hydroxide, halogen capture

1. Introduction

Rare metals are indispensable resources to various electronic devices, and the demand is increasing, but the price and output are not stability due to the uneven distribution of rare metal resources. Tantalum metal is one of the rare metals used for the tantalum capacitor in an electronic device. Tantalum capacitors with high

* Corresponding author. Tel.: +81-43-290-3466; fax: +81-43-290-3466.

E-mail address: z9t0210@students.chiba-u.jp.

concentration tantalum is manufactured in smaller sizes and higher performance than other types of capacitors, and are used in many products such as PCs and servers, and small-sized home appliances. The Japanese government selected tantalum as one of 14 priority minerals for recycling and as one of five most critical minerals for intensive recycling [1]. Based on these factors, the development of recycling technology from used tantalum capacitors is required from the point of view of "urban mines" [2]. The structure of a tantalum condenser is shown in Fig. 1 [3]. Tantalum condenser consists of the sintered compact which sintered the tantalum powder used as an electrode, mold resin used as the cover of a sintered compact, and the terminal connected with an electrode. In order to collect tantalum resources from a tantalum condenser, recovery of the sintered compacts with high concentration in stable mold resin is important. In the processing method to decompose mold resin, combustion [4] and solubilization [5] have been proposed previously, but these methods has some problems, such as high combustion temperature, high pressure to use pressure reactor, and generation of harmful halogen compounds to need another treatment.

Steam gasification processing is possible at reaction temperature lower than combustion and under normal pressure. The subject of cost or safety can be solved. As for what used sodium hydroxide, molten salt is cheap and can use it by ordinary pressure as a widespread reaction medium, and this is because the resolution of the organic halide can use it [6].

In this study, we investigated recovery of tantalum metal from used tantalum capacitor by using the steam gasification with sodium hydroxide for the recovery of tantalum compact by decomposition of mold resin and stabilization of halogenated compounds in the sodium hydroxide.

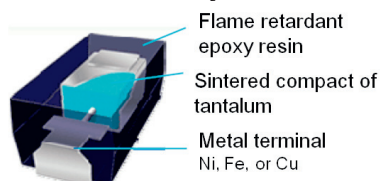


Fig. 1. Structure of tantalum capacitor

2. Materials and Methods

The tantalum capacitor (size: $6.0 \times 3.2 \times 2.5$ mm, model number: ESVC1V475M) was obtained from NEC /TOKIN Co., Ltd. The capacitor approximately composed of tantalum sintered compact (40 %), mold resin (44 %) and others (16 %). The composition of the mold resin is molten silica (70 %) [7, 8] OCN (o-Cresol novolac)-type epoxy resin (15 %), phenolic novolac resin (7 %) and flame-retardants (10 %).

The experimental apparatus is shown in Fig. 2. Sodium hydroxide put into the reactor, and heated with an electric furnace while flowing nitrogen (160 mL/min) and steam (1 mL/min) warmed by the heater. After heating to setting temperature (530 °C), tantalum capacitor (about 3 g) was thrown in the reactor, heated for 5 min, and then naturally cooled to room temperature. Since the capacitor was included in fused salt solid, it dissolves in distilled water, and filtrates to obtain the residual substance of the capacitor. The residual substance sieved under 500 μm to recover the sintered compact of tantalum in the condenser by destroying the mold resin. The contents of carbon and hydrogen in raw mold resin and sieved residue were analyzed by CHN elemental analyzer (Perkin-Elmer 2400).

During the experiment, the gas generated in the react pass through the water bubbling bottle to capture the halogen content in the gas, then the passing gas was analyzed by a gas chromatograph (GC-2014ATF, SHIMADZU). After the experiment, halogen contents in the filtrate and the solution in bubbling bottle were analyzed by ion chromatography (DX-120) to estimate the capture of halogen content in NaOH.

Download English Version:

<https://daneshyari.com/en/article/676198>

Download Persian Version:

<https://daneshyari.com/article/676198>

[Daneshyari.com](https://daneshyari.com)