METAL THIN FILMS IN SULFUR HEXAFLUORIDE DECOMPOSITION PRODUCTS

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ABSTRACT

This article describes the effect of the decomposition products formed from sulphur hexafluoride on thin film coating. Dependence of electrical characteristics of thin film coatings on quantity of inpurities contained in gas decoposed by sparks and refresh abilities of thin film coating.

1. INTRODUCTION

Sulfur hexafluoride is used as a insulating and extinguishing medium. This gas could be decomposed in electrical discharge or other source of high temperature. It is completely decomposed in temperature over 3000K. The most of decomposition products are very unstable and quickly recombine back to sulfur hexafluoride. Some products are very corrosive and react with inpurities or with construction materials of chamber or electrodes. These reactants are stable in gaseous or solid state. Effects of these decomposition products on thin film conductors and its dependability on quantity of these products and recombination processes are described in this article.

2. EXPERIMENTAL

Sulfur hexafluoride was decomposed in experimental chamber by electrical sparks. After each 60 minutes was analyzed sample by gas chromatography. It was possible to determine increasing amount of decomposition products in gas. Quantity of decomposition products depends on contamination by gas and water. Sparking lasted 1440minutes with pauses in the night. In these pauses took effect recombination and unstable elements turned to more stable elements. In graph could be it seen as a step change of gasses quantities. The amount of SOF_2 was decreasing and CO_2 was increasing, probably passed off oxidation reactions with carbon in camber equipment, especially in electrodes. These gasses were detected: CF_4, CO_2, SO_2F_2 a SOF_2. The time behaviour of impurities is shown in Fig. 1.

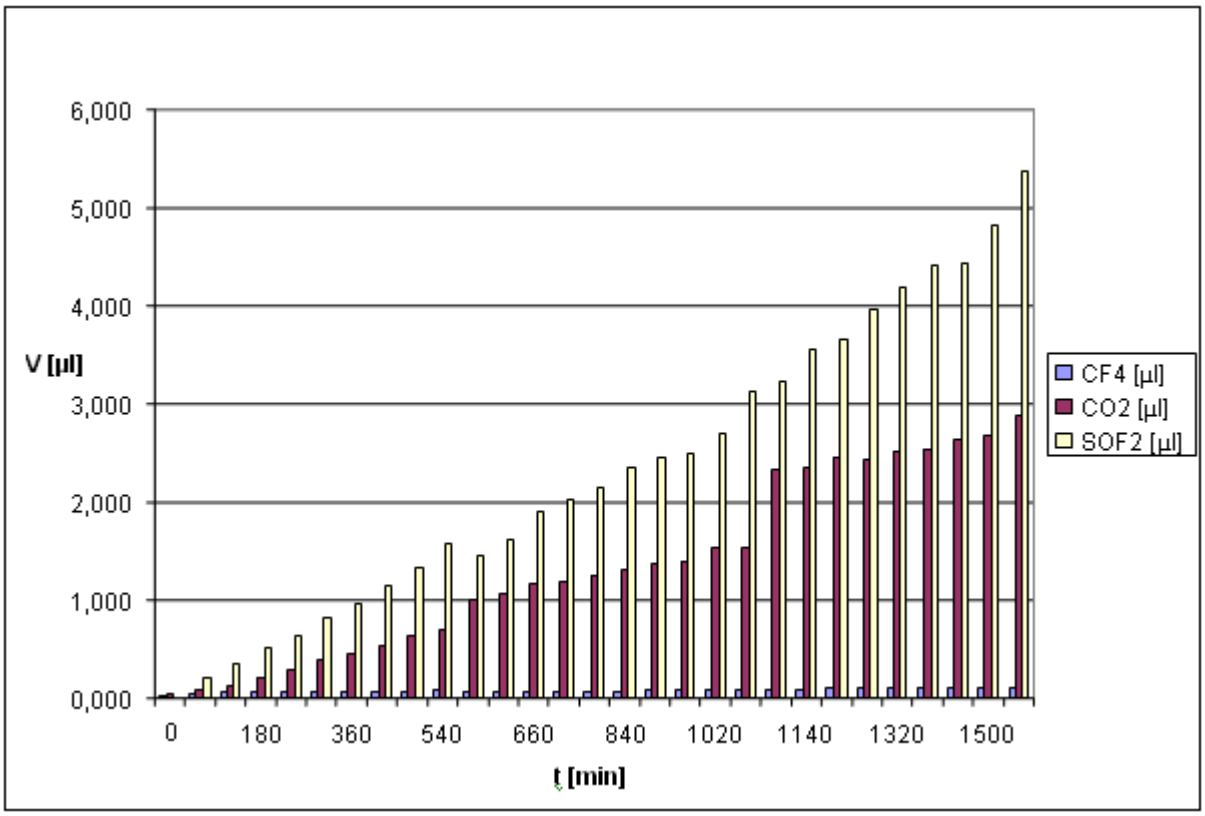

Fig. 1: Quantity of decomposition products in dependence on time with Cu 1,25 µm

Experiment was conducted on thin films made out of copper and chromium. These metals are used for contacting semiconductors or other electrical applications. Samples were made by vacuum evaporation on silicon based ceramics – Sital. Six samples were made, (3x Cu – 0,85µm, 1,15µm, 1,25µm and 3x Cr – 0,15µm, 1,25µm, 0,24µm). Five of them were used for measuring in sparked gas. The sixth sample is left in SO_2F_2 atmosphere for long-time testing of effect on chromium film. The electrical wires were fixed on the samples by the conductive paste SL 65 for measuring electrical characteristics. The electrical resistance of sample was measured each 60 minutes. Resistance of samples increased by the increasing quantity of decomposition products and corrosion was seen. Copper films showed larger changes of resistance than chromium films, the resistance decreased in night pauses, it is shown in fig.2. Chromium samples has less response to corrosion, but the corrosion continues even in relaxation time, Fig.3.

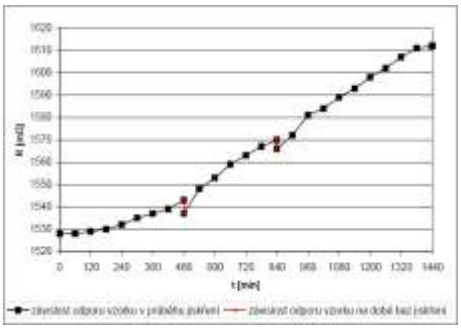

Fig. 2:Resistence of Cu 1,25 μm depended on time

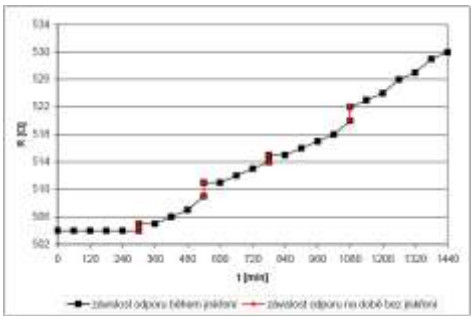

Fig. 3:Resistence of Cr 0,15 μm depended on time

3. CONCLUSION

Corrosive effect on sulfur hexafluoride decomposition products on thin metal films was discovered. Copper film has lower resistence to corrosion influence than chromium. Increasing of electrical resistence was dependent on thin film thickness. Thinner films has greater changes of electrial resistence. Copper featured ability to regenerate if sparing was interrupted. Chromium film was more imunne to corrosive influence of decomposition products.

ACKNOWLEDGMENTS

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