

# PRESSURE-SENSITIVE RESISTIVE SENSORS FROM OXYGENATED C<sub>60</sub> FILMS

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## Introduction

The intensive researches in properties of fullerene films today are of important practical interest [1]. Strong dependence of conductivity of fullerene film on ambient air pressure allows to hope of using these films as a material sensitive to pressure [2]. Meanwhile the research of fullerene film properties sensitive to pressure in the pressure sensors require for additional efforts.

## Experimental

Polycrystalline fullerene films C<sub>60</sub>/C<sub>70</sub> (99.9% purity) were obtained by gas-phase deposition. The contents of C<sub>70</sub> in the film was about 12% in accordance with the mass-spectrometry data. The crystallite size was about 0.3 - 0.5 mkm. The right angle sapphire was used as the base for objects of sampling. Beforehand the chrome electrical contacts were deposited on sapphire surface. Fullerene film was deposited over the chrome contacts with a gap 2.5 mm between each other, the width of contacts is 8 mm. Fullerene films were thermal-annealed in air medium. The thickness of fullerene film was about 8 mkm. The technological conditions for fullerene films production are: temperature of film deposition - T<sub>d</sub>=963K; pressure in chamber - 5 torr; leakage velocity of hydrogen in chamber - V<sub>H</sub>=20 ml/min; time of deposition - t=30 min; temperature of annealing -T<sub>an</sub>=643K. The resistance of film between chrome contacts was measured.

## Results and Discussion

The temperature dependences of resistance of annealed samples have strong dependences of functions with a negative temperature factor. It was found the strong dependence of C<sub>60</sub> film resistance from ambient air pressure below the atmospheric value. These dependences are shown in Figure 1. The function R<sub>an</sub>(P) at T<sub>o</sub>=293K is of non-linear type of dependence in low-pressure range especially. The pressure sensitivity in range about normal pressure is S=6.8\*10<sup>-5</sup> Pa<sup>-1</sup> and S=2.55\*10<sup>-3</sup> Pa<sup>-1</sup> in range about zero pressure. These values are much more in comparison with the values for silicon or polysilicon pressure sensors (S=10<sup>-7</sup> -10<sup>-8</sup> Pa<sup>-1</sup>). The effect pressure

influence on the fullerene film resistance depends on temperature. The effect looks much more weaker at T=353K, but the function R<sub>an</sub>(P) is here almost linear. The pressure sensitivity is S=1.18\*10<sup>-6</sup> Pa<sup>-1</sup>. The resistance changes were also measured on surplus ambient air pressure. The function R<sub>an</sub>(P) is of linear type, the pressure sensitivity is S=2.3\*10<sup>-6</sup> Pa<sup>-1</sup> in this case.

## Conclusions

As we suppose C<sub>60</sub> thin films would be used as material for resistive sensors for ambient air pressure measurements, if the resistance of the films will be lower. Such films will be useful for pressure range less than 200 torr. These films would be used as thermoresistive material.

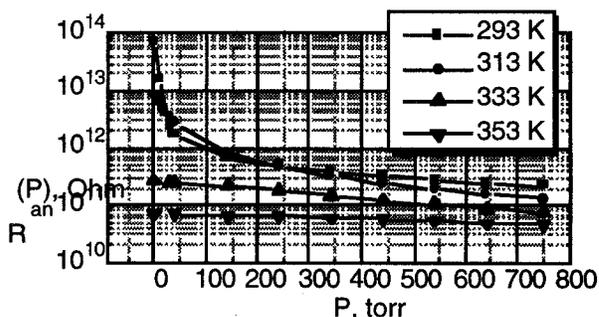


Figure 1. The pressure dependences of resistance of annealed sample.

## References

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