

# EVA ENCAPSULATION SHEET FOR PHOTOVOLTAIC CELL

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**Abstract :** Due to high demand of energy in every sector and the non renewable sources of energy are faded day by day so a new concept of energy comes in the existence named as renewable source of energy. There are many renewable sources of energy available such as windmill, solar panels etc. so in the modern era the use of solar panel is most effective way that come out be in the market to cope up with the energy demands. The solar module is very simple, easy and low cost method to obtain energy. In the article presented below shows that the solar module uses a material known as EVA named as Ethylene Vinyl Acetate. This material is used as an encapsulating material in solar module. This material is translucent and has excellent weathering properties.

## Index Terms – Eva, Encapsulation, Solar Module

### 1. Introduction

Eva is the most important material used in the solar module fabrication. The Eva here plays a very important role of encapsulation as it covers the silicon wafer from top and bottom.

Eva is a copolymer which is formed with the combination of ethylene and vinyl acetate. Commercially only four grades are available of which 28% Eva is used in the solar module. But in this paper you will see that the comparison of 28% Eva with 18% Eva.

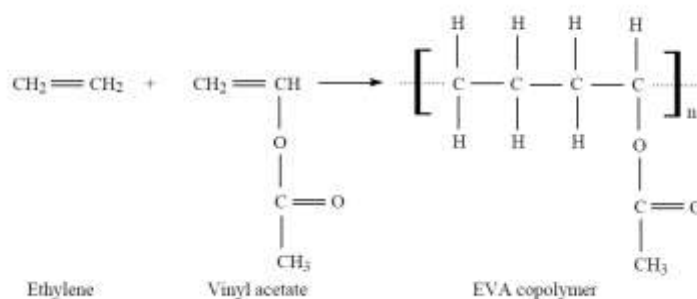


Figure 1: EVA Copolymer

### 2. Experiment

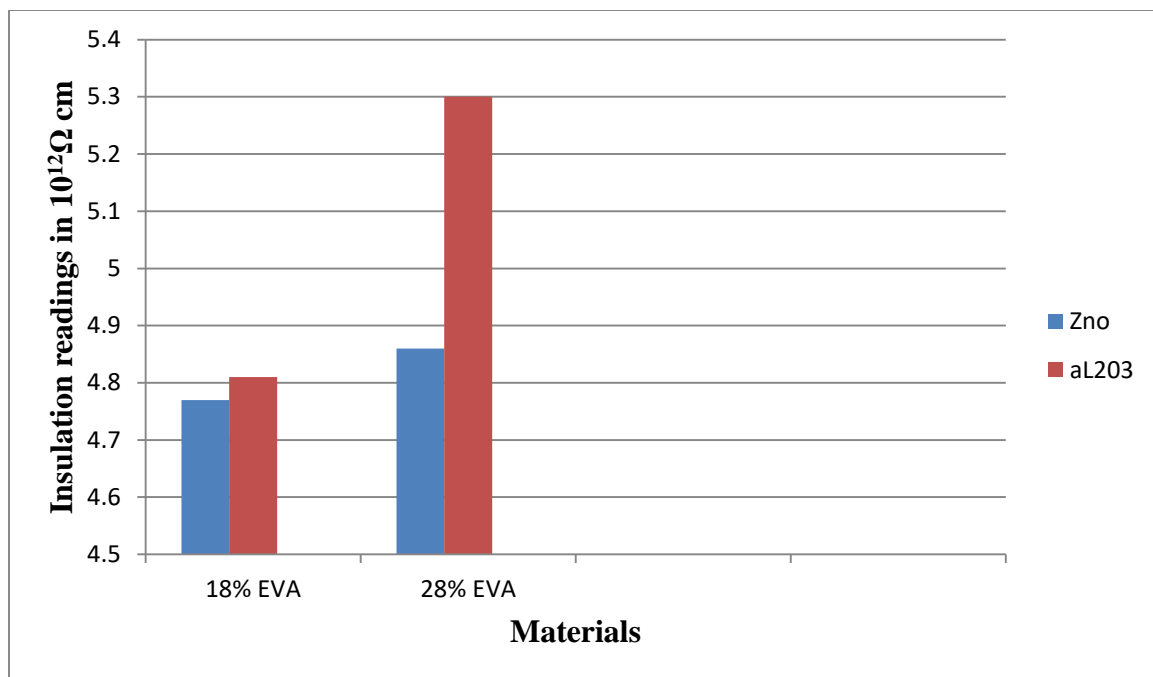
In the experiment below there are two type of commercial grades of Eva are used i.e. 18% va and 28% va.

In order to compare the two grades we have to carry out some testing which are listed below:

- Electrical insulation test
- Gel content test
- Thermal conductivity test
- UV test

#### 2.1 Electrical Insulation Test

This test method is used to determine the insulation in the Eva of the two grades. The test method used here is ASTM D 257. So after testing following are the results were obtained which are as shown below.



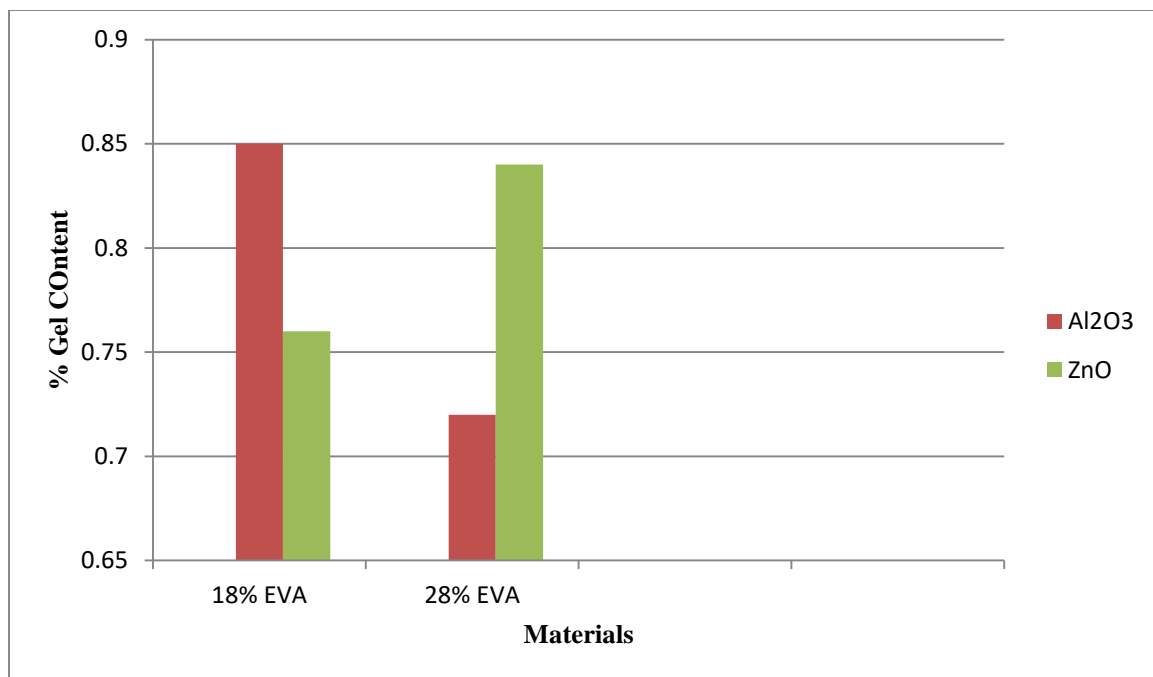
Graph 1: Comparison of electrical insulation of 18% and 28% Eva having filled with ZnO and Al<sub>2</sub>O<sub>3</sub>

## 2.2 Gel content test

This test is necessary to determine the amount of rubbery part in the Eva material as with the increasing vinyl acetate content the rubbery nature of the EVA increases. So after performing the test the results can be shown with the help of comparison graph 2.

GEL CONTENT TEST	
MATERIALS	RESULT
18% EVA MODIFIED WITH Al <sub>2</sub> O <sub>3</sub>	85%
18% EVA MODIFIED WITH ZnO	76.5%
28% EVA MODIFIED WITH Al <sub>2</sub> O <sub>3</sub>	72%
28% EVA MODIFIED WITH ZnO	84%

Table 1: Results after testing the gel content of EVA 18% and 28% filled with ZnO and Al<sub>2</sub>O<sub>3</sub>



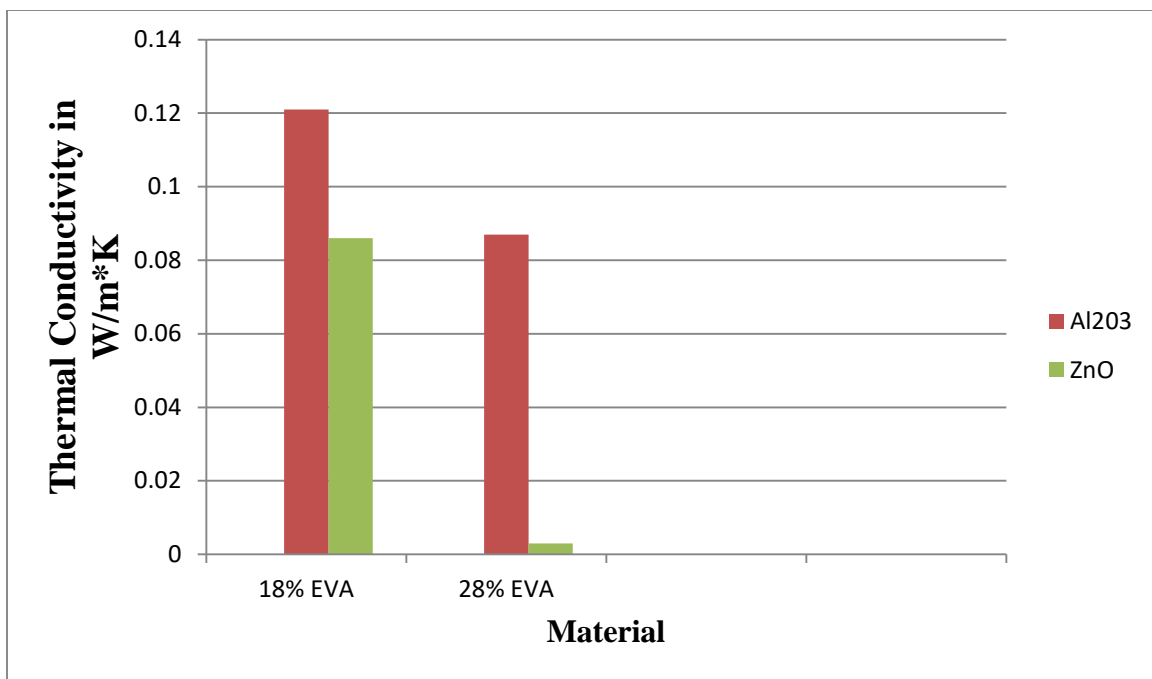
Graph 2: Comparison of gel content of 18% and 28% Eva having filled with ZnO and Al<sub>2</sub>O<sub>3</sub>

### 2.3 Thermal conductivity tests

This is very important test used to determine the conductivity of EVA at room temperature. So after testing was carried out some of the results were obtained which are as listed below:

THERMAL CONDUCTIVITY TEST	
MATERIALS	RESULT
18% EVA MODIFIEED WITH Al <sub>2</sub> O <sub>3</sub>	0.121 W/m*K
18% EVA MODIFIEED WITH ZnO	0.086 W/m*K
28% EVA MODIFIEED WITH Al <sub>2</sub> O <sub>3</sub>	0.087 W/m*K
28% EVA MODIFIEED WITH ZnO	0.003 W/m*K

Table 2: Results after testing the thermal conductivity f EVA 18% and 28% filled with ZnO and Al<sub>2</sub>O<sub>3</sub>



Graph 3: Comparison of thermal conductivity of 18% and 28% Eva having filled with ZnO and Al<sub>2</sub>O<sub>3</sub>

**2.4 UV test**

As per many studies shown that Eva sheet is not compatible to UV radiation which results in the yellowing of EVA sheet and also lacks in the efficiency of solar module. In this testing i was able to carry out some of the results but before going further let us understand the process of testing which is listed below

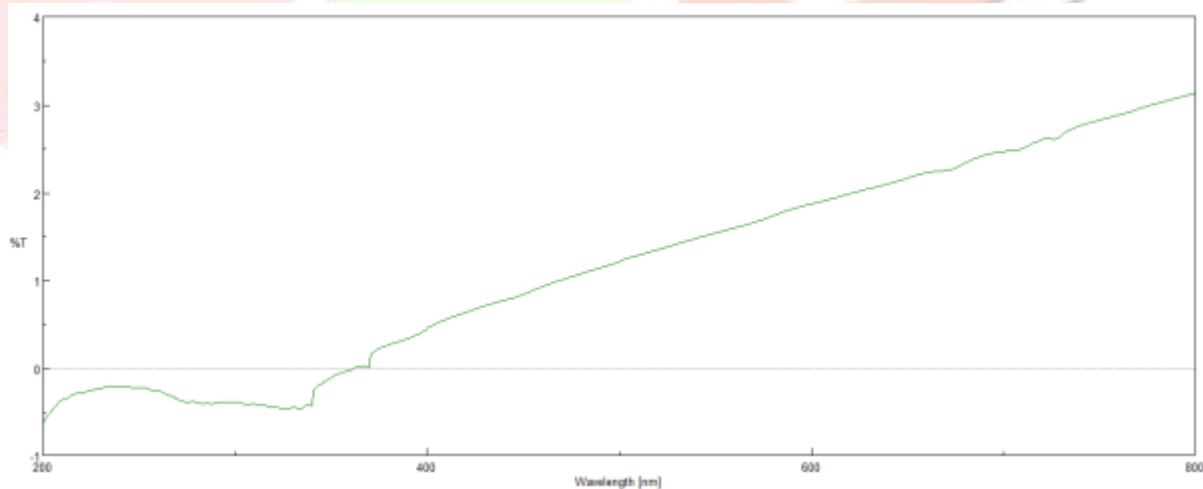


Fig -4: RESULTS OF 18% EVA MODIFIED WITH AL<sub>2</sub>O<sub>3</sub>

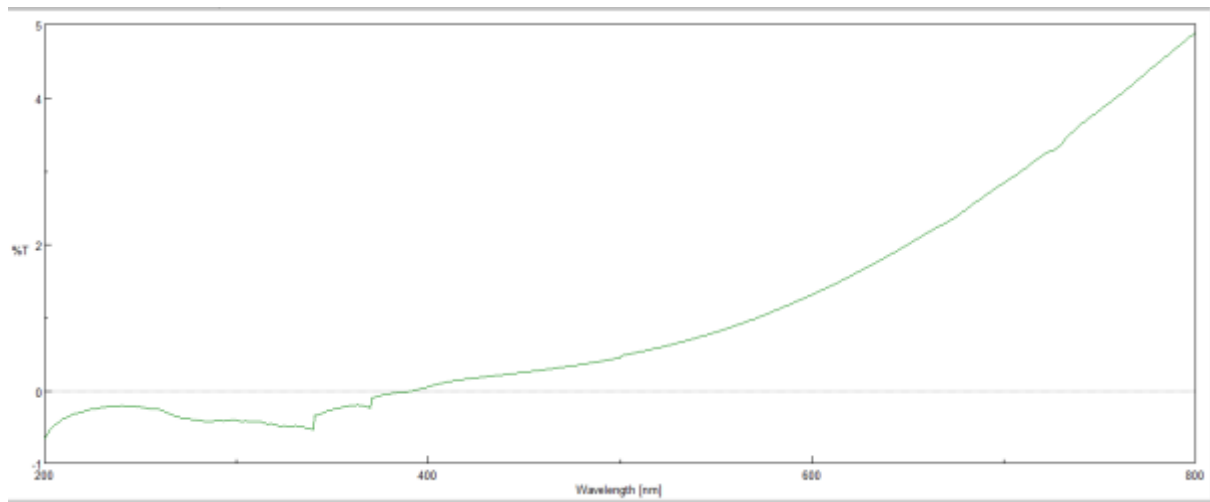


Fig -5: RESULTS OF 18% EVA MODIFIED WITH MgO

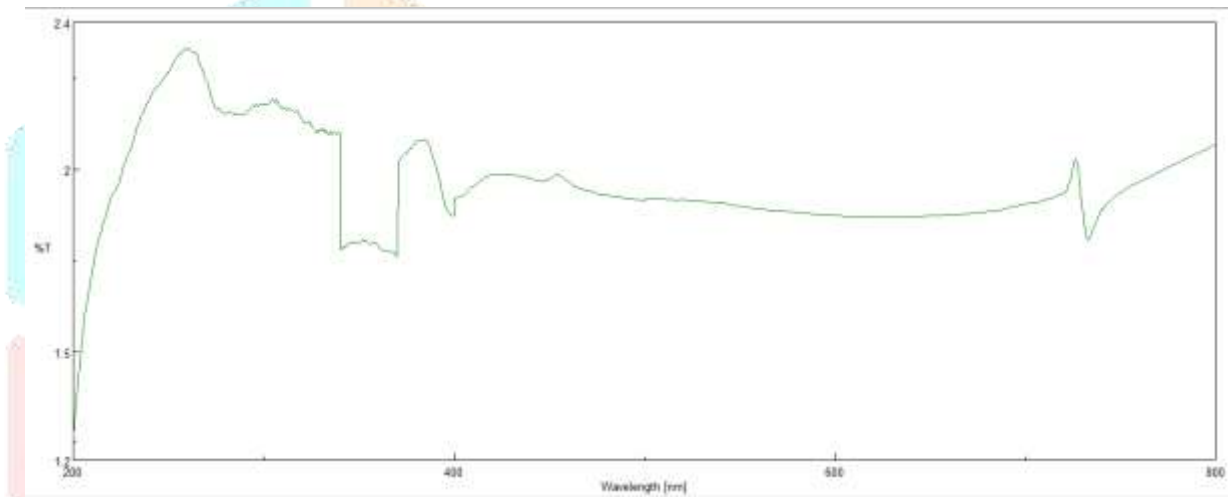


Fig -6: RESULTS OF 18% EVA MODIFIED WITH ZnO

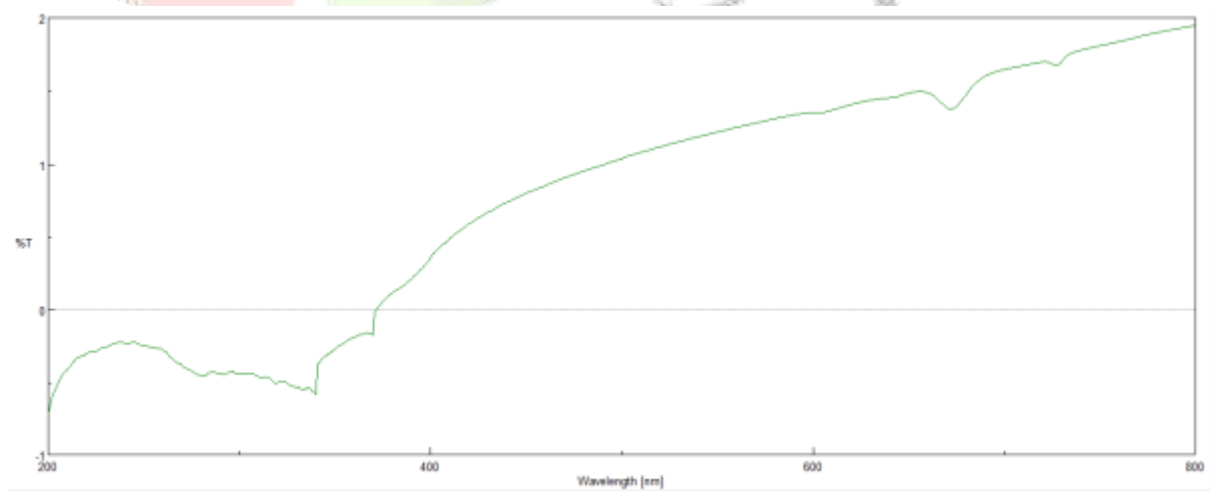
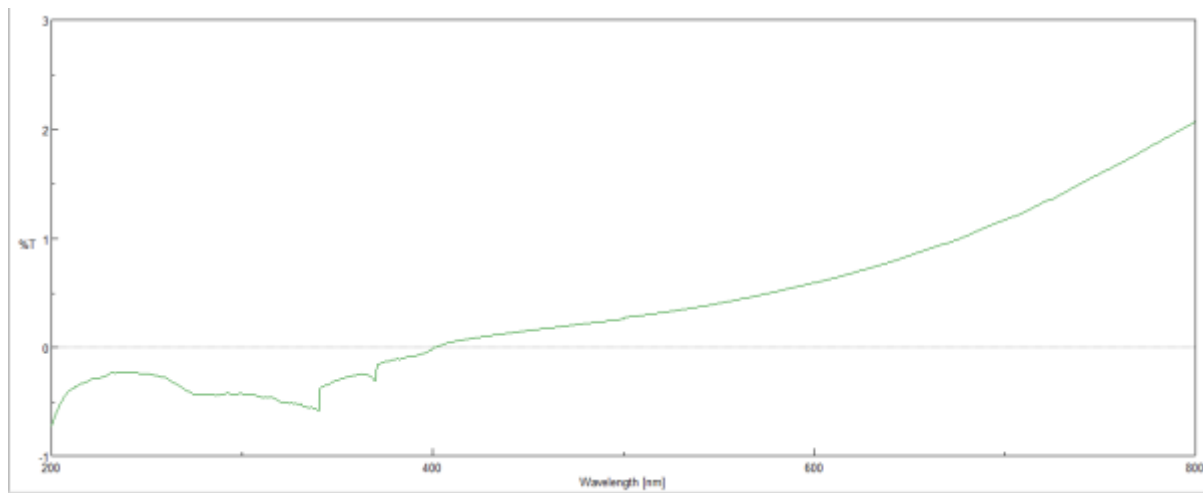
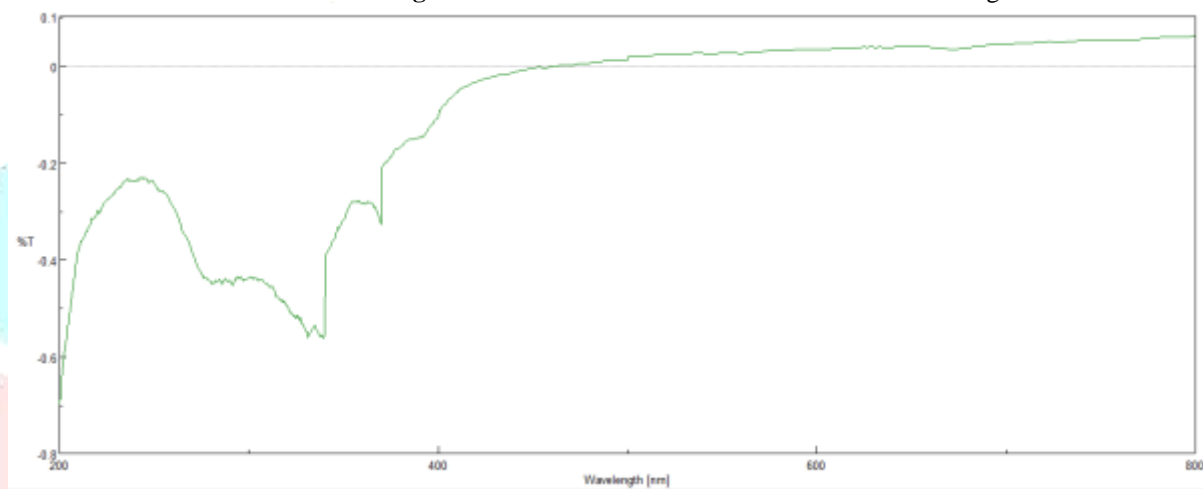


Fig -7: RESULTS OF 28% EVA MODIFIED WITH AL<sub>2</sub>O<sub>3</sub>



**Fig -8: RESULTS OF 28% EVA MODIFIED WITH MgO**



**Fig -9: RESULTS OF 28% EVA MODIFIED WITH ZnO**

### 3. Conclusion

From the above experiment we can conclude that in the case of electrical insulation in both the grade 18% Eva and 28% Eva which is filled with  $\text{Al}_2\text{O}_3$  showed better electrical insulation compared to both Eva grades filled with ZnO.

Secondly in the testing of gel content 18% Eva filled with  $\text{Al}_2\text{O}_3$  showed high gel content value compared to 28% Eva filled with  $\text{Al}_2\text{O}_3$ . On the second hand in the case of 18% Eva filled with ZnO poor gel content properties compared to 28% Eva filled with ZnO.

Finally in the experiment of thermal conductivity in both the Eva filled with  $\text{Al}_2\text{O}_3$  grades is higher compared to both Eva filled with ZnO.

### 4. References

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