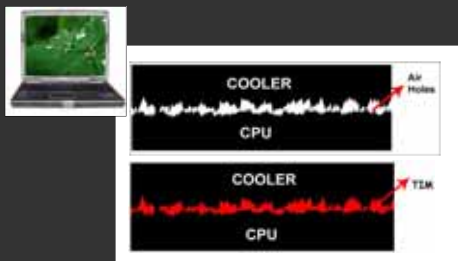


# PROCESSING AND CHARACTERIZATION OF THERMOPLASTIC COMPOSITE THERMAL INTERFACE MATERIALS

## introduction

To improve the cooling performance of the electronic systems, **thermal interface materials (TIM)** that offer a high thermal conductivity between coolers (i.e. heat sinks) and the heat generation source (i.e. CPU) play an important role in increasing performance and lifespan of device.



### Ideal Thermal Interphase Material (TIM)

- Thermally conductive
- Electrically isolative
- Low thermal expansion
- Processability

### The objective of the study is:

- to develop an elastomeric TIM based on a thermoplastic matrix filled with thermally conductive but electrically insulating hBN particles by applying extrusion and subsequent hot-pressing
- to investigate the effects of blend composition and hBN type and loading level

### Approach:

- A thermoplastic elastomer matrix filled with thermally conductive fillers

### Advantages:

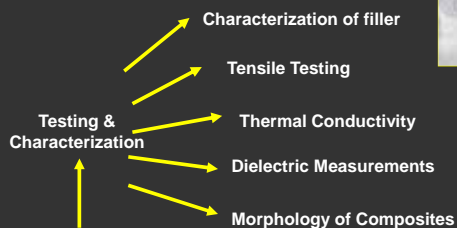
- Thermal conductor
- Electrical insulator
- Low thermal expansion
- High temperature Stability
- High compressibility

## experimental

- SEBS: G 1650E, Kraton, USA
- EVA: Evatane33-45, ARKEMA, USA
- BN: VSN 1149, VSN 1159 and VSN 1142, ESK, Germany



Compounding  
Polymer matrix + Filler (SEBS/EVA) (hBN)

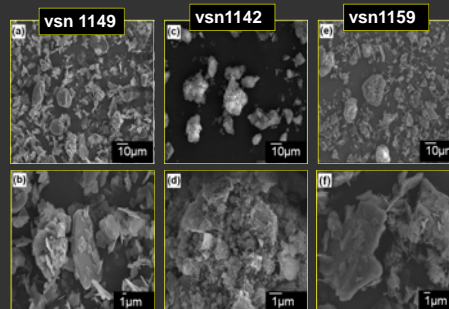


### Parameters:

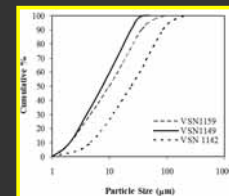
- Polymer Matrix: 10,50,70% SEBS– 90,50,30% EVA by wt
- Filler loading level: 30,50% hBN by weight
- Filler type: VSN 1149, VSN 1159, VSN 1142

## results

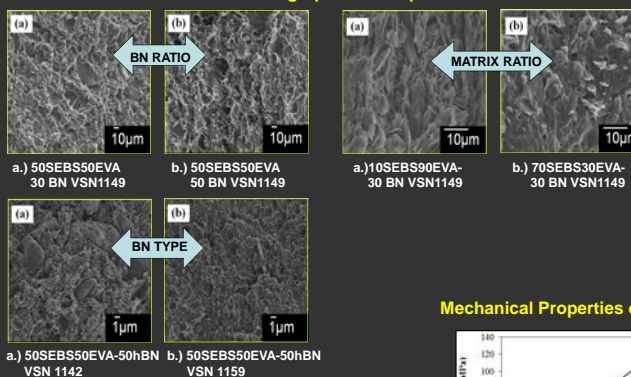
### SEM micrographs of hBN



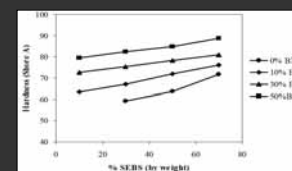
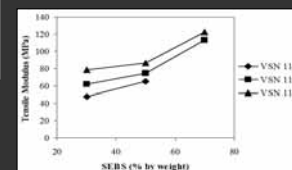
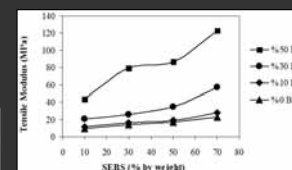
### Part Size Distribution of hBN



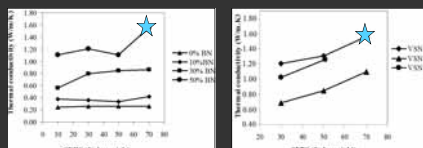
### SEM micrographs of Composites



### Mechanical Properties of Composites



### Thermal Conductivity of Composites



### Dielectric Constants of Composites

Material	Dielectric Constant (ε <sub>r</sub> )	
	25 °C	50°C
10SEBS90EVA	5.07	4.23
30SEBS70EVA	4.37	4.21
50SEBS50EVA	3.84	3.60
70SEBS30EVA	3.59	3.44
50SEBS50EVA-10 VSN1149	3.53	3.57
50SEBS50EVA-30 VSN1149	3.63	3.31
10SEBS90EVA-50 VSN1149	4.35	4.16
30SEBS70EVA-50 VSN1149	4.05	4.07
50SEBS50EVA-50 VSN1149	3.82	3.63
70SEBS30EVA-50 VSN1149	3.46	3.28
50SEBS50EVA-50 VSN1142	4.19	3.94
50SEBS50EVA-50 VSN1159	4.05	3.91

## conclusions

- ✓ SEBS/EVA/hBN based thermal interphase materials were successfully prepared
- ✓ the wettability of the matrix and the extent of interaction between matrix and filler have a critical importance in thermal conductivity
- ✓ thermal conductivity and mechanical properties of polymer composites depend on SEBS/EVA ratio and BN loading level
- ✓ the type of BN has a little effect on the dielectric constant

Sebnem Kemaloglu<sup>1</sup>, G. Ozkoc<sup>1</sup>, A. Aytac<sup>1</sup> and

M.P. Quaedflieg<sup>2</sup>

<sup>1</sup>Kocaeli Uni., Dept. of Chemical Eng., Kocaeli/TURKIYE

<sup>2</sup>DSM Xplore, Geleen/The NETHERLANDS

