# CONCLUSION

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The measurements carried out in this work allows us to conclude the following :

1. The electrical conductivity, $\sigma$, of carbon black loaded butyl rubber *increases* by adding 20 phr $BaTiO_3$-ceramic to rubber mixtures. In this case temperature coefficient of conductivity [TCC] of corresponding samples *decreases*.

2. The decrease in $\sigma$ due to Joule heating effect occurs as a result of the *thermal expansion* of the hopping paths between carbon black particles and/or aggregates and is comparable with the changes occured in $\sigma$ due to external heating.

3. Theoretical analysis of the obtained data allows to calculate reasonable values of the *specific heat* of carbon black-loaded butyl rubber composites.

4. The values of the *time constants* $\tau_g$ and $\tau_d$ due to sample heating and cooling respectively are characteristic constants for each type and concentration of carbon black and varies from 2 to 5 min.

5. By using the *flash method* technique the values of the specific heat of the composites are in good agreement with that which obtained from **time-temperature [t-T]** characteristic curves.

6. Each type of investigated carbon black *possesses* a *critical* concentration at which a *maximum* value of heat produced by Joule effect was obtained; namely, **HAF [80 phr], GPF [60 phr], SRF [100 phr]** and **LAMP [70 phr].**

7. The heat capacity of butyl rubber composites *decreases* as the carbon black concentration increases.

8. Both the heat produced by Joule effect and the values of the specific heat were found to be markedly affected by the *ambient temperature*.

9. The heat produced by Joule heating effect increases as surface area to volume [S/V] ratio of the sample increases.

10. The *heat capacity* of the investigated rubber composite is equal to the summation of the heat capacities of *individual ingredients* and is governed by the **rule of additivty.**

11. The electrical and thermal parameters of composites containing 100 phr HAF, GPF, and SRF were not markedly affected after *6 months of continuous power onset operation* using the mains ac-power source [50 Hz].