

Properties and behaviors of polymeric systems containing mineral fillers

Mineral fillers are very often used to modify polymer properties. Modification efficiency depends on chemical and physical structure of the filler. The high efficiency is expected for “nanofillers”, clay minerals or other materials which can be dispersed in polymer matrix as small particles of nanometer dimensions. However, there is sometimes difficult to prepare mixtures with required quality and reproducibility. Any research in that field is welcome to move our knowledge forward.

The thesis structure is classical. Chapter 1 “Current situation of the studied problem” gives review about mineral fillers with emphasis on clay minerals and polymer nanocomposites. Chapter 2 introduces aims and research plan. Used methods, materials and sample preparation are given in chapter 3.

The core of the thesis presents chapter 4 “Results and discussion”. Results are given in logical order, mostly in the form of tables and also as graphs. It makes their comparison and discussion more clear and easy for reader.

The work is written in English and is well understandable for me. However, I am not expert to assess real language level. The number of mistyping or incorrect words is very low.

I have a few questions to applicant or comments on presented results:

- I cannot agree, that “The long elastomer chains are physically crosslinked during “vulcanization with ...”. (page 15, 1st paragraph)
- I recommend to be more careful when different units are used, e.g. *m* and *cm* in formulas on p. 17 and 18. Than a multiplying factor has to be added to keep them correct.
- P. 29 at bottom: "... Monomer is then dispersed ..." (Filler ?).
- The definition rubber modulus on p. 39 should be "... and is defined as tensile stress at a particular elongations ...". From that reason in fig. 70 (p. 79) should be "M100" or "Tensile stress".

Why do you select Parker Hannifin catalogue "Precision O-ring handbook" (ref. [75]) as the reference for Elongation at break, Modulus and Tear strength?

- P. 40: The type of crosslinks, as the most important structure parameter for CS of cured rubbers, is not mentioned.
- P. 58: I do not think that results of ref. [81] – [83] (from years 1997, 1994 and 1995) are recent research.

- P. 60: The statement "... loss factor for compounds with nanoclays and with kaolin peak at a temperature of approximately 60 °C, ..." corresponds with curves in the Fig. 46. How do you know that? Why peaks cannot be at just 70 °C or even at higher temperatures?
- P. 79-80: There is interesting the highest tear strength has been obtained for compound with 10 phr of Cloisite 25A and 30 phr of silica and other mechanical properties for compounds with 15 phr of the Cloisite. The explanation that sharp platelet edges can (at higher concentration) facilitate crack propagation can be applied for tear strength, but for tensile strength as well.
- P. 80: "... The reduction of permeation is caused by the plate-like shape of exfoliated or intercalated nanoclays. ..." How do intercalated nanoclays reduce permeation compare to non-intercalated ones, and compare to exfoliated ones?

Conclusion

The thesis brings new results which contribute to the knowledge about polymer materials and are promising for rubber industry. The aims were achieved. The author proved his capability to perform scientific research. The thesis fulfills all requirements and I recommend it for the defense to gain the scientific title "Doctor of Philosophy".

In Prague, 12th September 2013

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