

**OPPONENT'S REVIEW
of PhD. dissertation thesis**

Author: Ing. Soňa Zenzingerová.

Title: Polymeric blends based on linear and branched polypropylene: crystallization, polymorphism and properties

Opponent: prof. Ing. Pavol Alexy, PhD.

The submitted thesis focuses on an in-depth study of the morphology of iPP in relation to the presence of long branches in the PP structure, as well as the effect of a nucleating agent on the kinetics of crystallization and the morphology of crystalline regions. The doctoral thesis is structured as a commented set of four published papers.

The theoretical background is presented over 14 pages, supported by 80 references, and followed by a concise summary of the published papers. This part of the thesis is written with precision, clarity, and excellent readability.

The author's experimental results were published in five papers, with Ing. Zenzingerová as the first author in three of them. Four of these papers are discussed in the dissertation thesis. I will not evaluate the quality of the papers in detail, as one is ranked Q1 and the others are ranked Q2, signifying high-quality journals. Moreover, all discussed papers successfully underwent the peer review process. However, I would like to highlight the excellent organization of the presented work. The published papers are logically interconnected, forming a cohesive and comprehensive scientific contribution.

The results and findings based on the author's experimental work provide valuable insights into the crystallization of PP under various conditions, particularly in relation to thermal history. Additionally, the influence of standard nucleating agents, as well as the presence of long-branched PP (exhibits self-nucleating effect), as nucleating agents for linear iPP, on the crystallization and morphology of crystalline regions was thoroughly investigated.

I have only one question regarding the theoretical part and two topics for further discussion:

1. On page 15, at the top, the author writes: "The disordered phase can be stable up to 155 °C and can also be formed when iPP is deformed in the solid state by uniaxial stretching [46,47]." What does the author mean by the term "solid state"? Does this refer to a polymer below its T_g, or a polymer as a highly viscous liquid?
2. In the theoretical part, you mentioned that LCB-PP can also be used as a modifier of the rheological properties of the final material, particularly to improve melt strength for better

processability in technologies such as film blowing, thermoforming, etc., including also foaming. Do you have any data on the rheological behaviour of your blends of iPP/LCB-PP?

3. Crystallinity and the morphology of crystalline regions affect not only the mechanical and optical properties of final products. PP is widely used in the packaging industry, particularly for food packaging, which often requires excellent barrier properties. Semi-crystalline polymers typically exhibit better barrier properties than amorphous ones. In your opinion, can the type of crystalline phase structure influence barrier properties at the same overall level of crystallinity?

In my opinion, the presented dissertation represents a high-quality scientific contribution by Ing. Soňa Zenzingerová and provides new and valuable knowledge in the studied field. Therefore, I recommend the presented dissertation for defence and suggest that **Ing. Soňa Zenzingerová** be awarded the title:

„philosophiae doctor“, PhD.

Bratislava, 15.1.2025

prof. Ing. Pavol Alexy, PhD.