

## Effect of Nucleating Agents on Crystalline Orientation and Warpage of Injection-molded Polypropylene

Minqiao Ren\*, Jianjun Yin, Xuanbo Liu, Yujing Tang, Taoyi Zhang, Meifang Guo, Jinliang Qiao  
Sinopec Beijing Research Institute of Chemical Industry, Beijing, 100013, People's Republic of China  
\*email: renmq.bjhy@sinopec.com

Although various types of nucleating agents (NA) have been used in polypropylene (PP) for commercial products, the effects of NAs on structures and the relation to the physical properties of PP have not been clarified. The present work reveals the crystalline orientation of injection-molded PP specimens with direct comparison of two types of NAs via wide-angle X-ray diffraction (WAXD) and small-angle X-ray scattering (SAXS) techniques. The results show that NA-I has the ability to induce a highly specific crystallographic b-axis orientation to normal direction of PP specimen. This peculiar crystal orientation is considered to originate from the flaky shape of NA-I. In a mold cavity, NA-I particles are oriented strongly along the injection direction in the melt and crystallization proceeds with the (040) plane of PP crystal piling on the plate planes of these particles, so b-axis being aligned parallel to the normal, or thickness, direction of the molded part, while the a\*- and c-axes are distributed about the machine and transverse direction. The b-axis orientation to the thickness direction is much weaker for PP with NA-II. The degree of crystallographic b-axis orientation is calculated based on two different methods. The correlation of mold shrinkage and degree of b-axis orientation of PP specimen was obtained. The mold shrinkage of PP tends to be more isotropic and the potential warpage is reduced when the degree of b-axis orientation to the thickness direction is maximized.

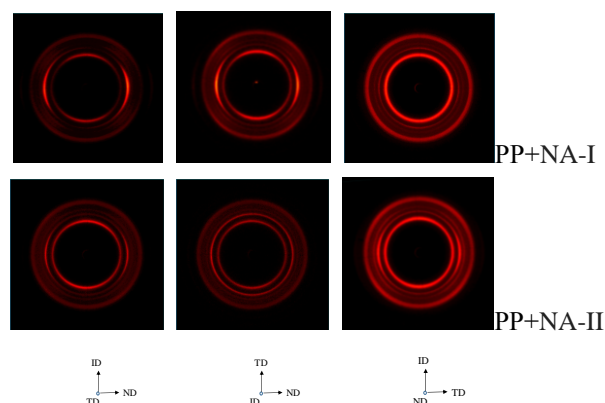


Figure 1 WAXD images of injection-molded specimens of PP with different types of NAs taken from various directions.

### References:

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