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SYNTHESIS OF METHACRYLIC POLYMER ADDITIVES WITH DIFFERENT AMOUNTS OF BENZYL METHACRYLATE AS POUR POINT DEPRESSANTS FOR DIESEL FUEL

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A major disadvantage of diesel fuel compared to gasoline is its tendency to precipitate higher *n*-paraffins at lower temperatures, resulting in diesel fuel having poorer low-temperature properties compared to gasoline. Improving the low-temperature properties of diesel fuel can be achieved by blending distillates with a higher *n*-paraffin composition with other components with a lower *n*-paraffin composition. This can also be done more economically by the process of catalytic dewaxing, winterization or by addition of polymer additives. They can inhibit nucleation, growth or agglomeration of *n*-paraffin crystals, leading to an improvement in the low-temperature properties of diesel fuel and an expansion of the possible range of applications. In our research we were focused on synthesizing polymer additives that improve low-temperature properties, with an emphasis on additives that improve the pour point (PP) of diesel fuel. We synthesized additives based on benzyl methacrylate (BMA) with octadecyl methacrylate (ODMA), dodecyl methacrylate (DDMA) and 2-(*tert*-butylamino) ethyl methacrylate (TBAEMA) with different molar ratios of the comonomers. The thermal properties of the additive formulations with non-additivated diesel fuel were investigated by differential scanning calorimetry (DSC). The influence of the additive on the crystal morphology and crystallization behavior was studied by optical microscopy with polarization, and the pour point (PP) was investigated according to ASTM D5950.

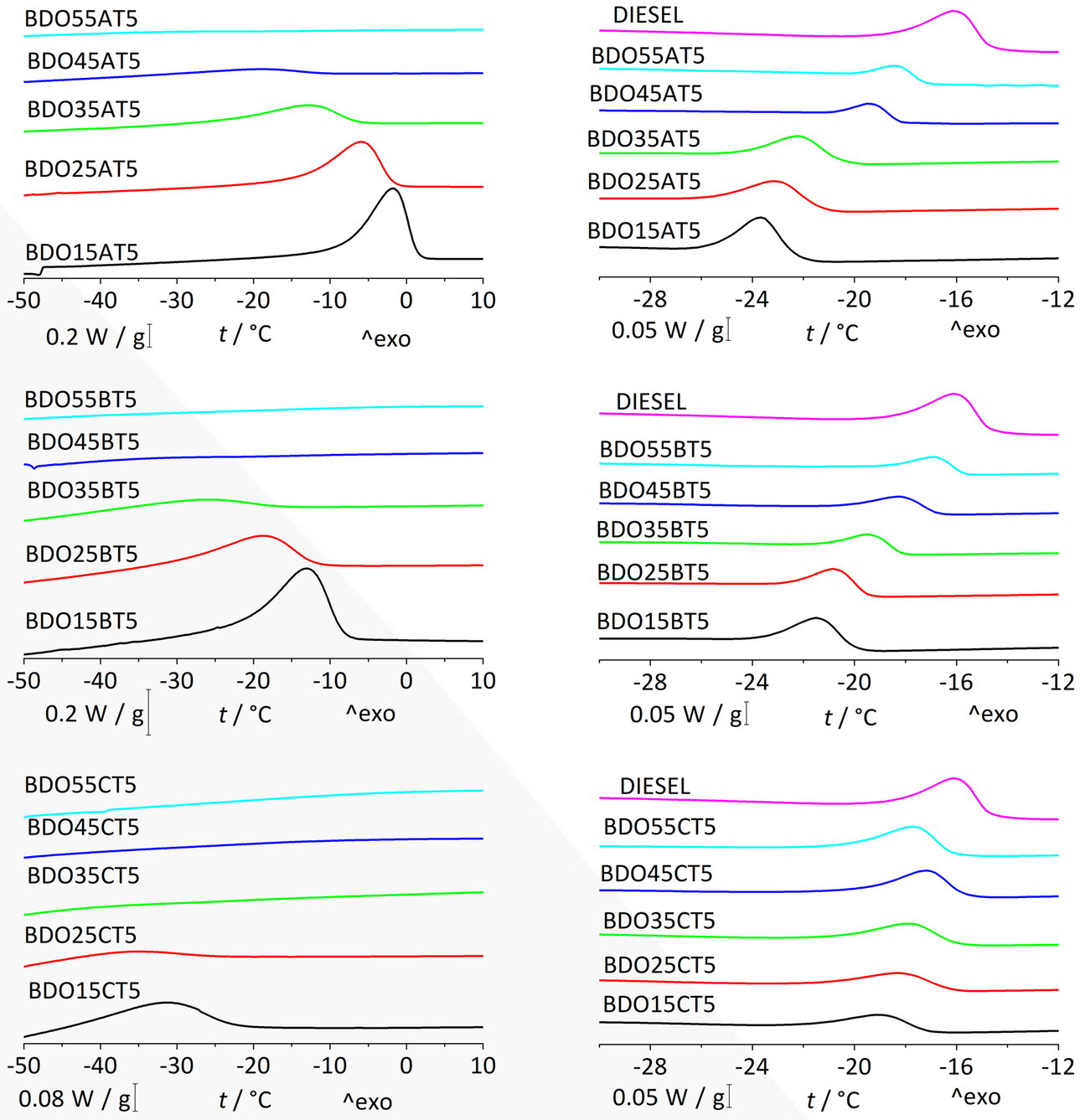

Figure 1. DSC analysis of the synthesized additives (left) and their formulations with diesel (right)

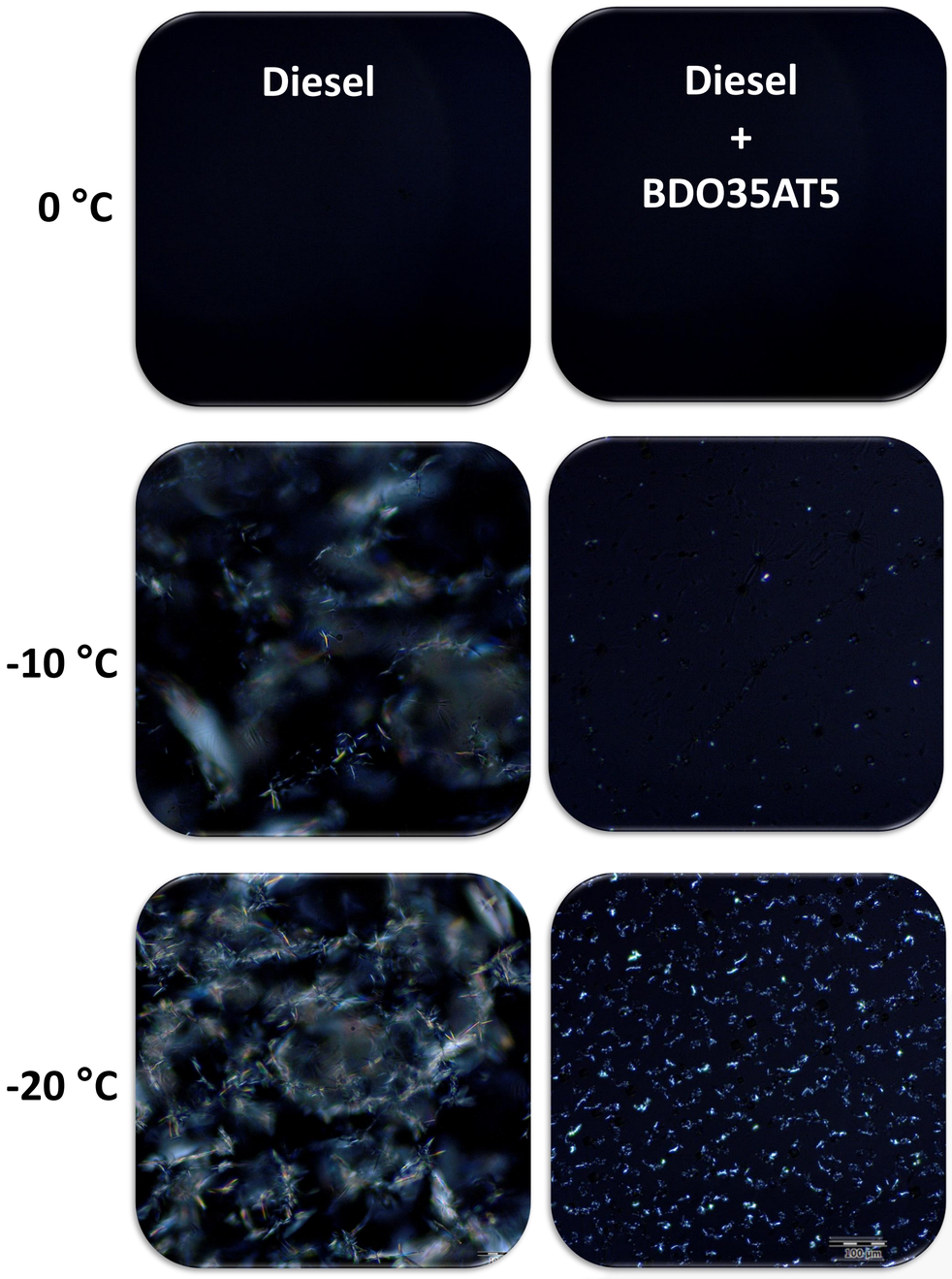

Figure 2. Crystallization morfology behaviour of diesel and an additive/diesel formulation observed with optical microscope at 0, -10 and at -20 °C

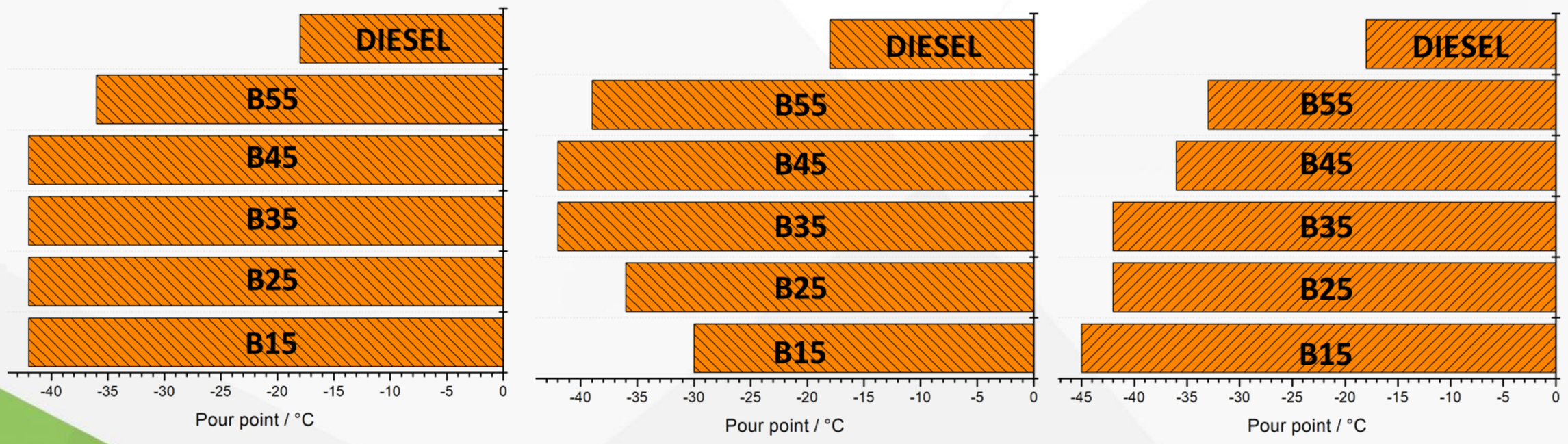

Figure 3. Pour point values of diesel and additive /diesel formulations measured according to ASTM D5950

The thermal properties of the additive formulations with non-additivated diesel fuel studied by differential scanning calorimetry (DSC) showed that the amount of ODMA in the additive has an effect on the crystallization temperature. At higher amounts of ODMA, the crystallization temperature of the additive increases, while the formulations with diesel fuel show the opposite trend. A change in crystal morphology and crystallization behavior of additive/diesel formulations studied by optical microscopy with polarization was observed. The synthesized additives changed the morphology of wax crystals in diesel from large needle-like wax crystal structures to smaller spherical structures with a higher number of crystals. All the synthesized additives greatly improved the pour point of diesel fuel. Polymer additive BDO15CT5 has shown the best result and decreased the pour point from -18 °C to -45 °C.

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