Tech Bulletin

Thermal Analysis of DT 6060

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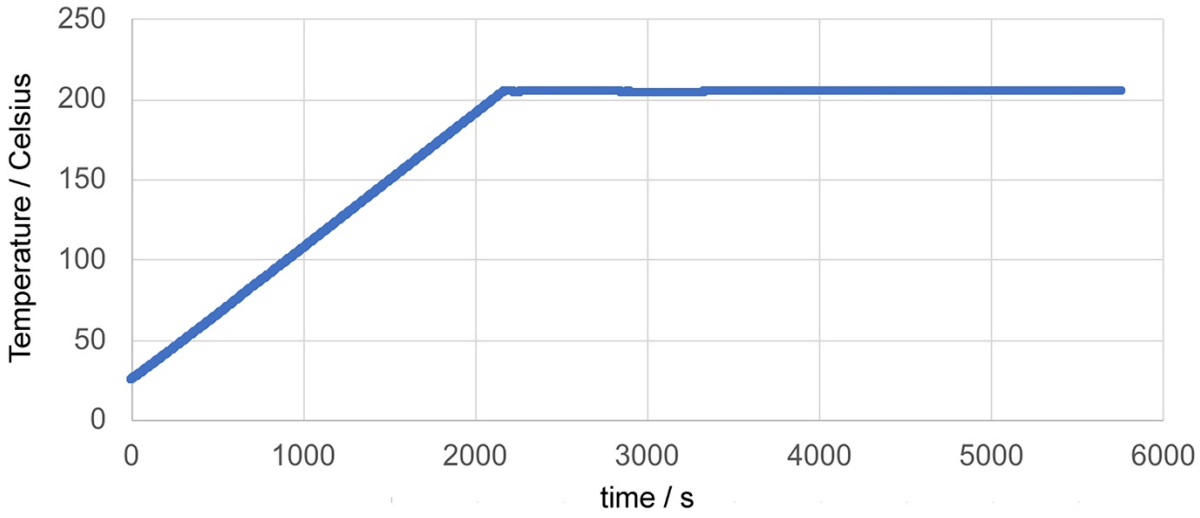
To model the behavior of DT 6060 on steel during thermal conditions typical for mold release agents, we ran three consecutive heating cycles with a coating of DT 6060 on steel. The first run was performed immediately after DT 6060 was applied, the second and the third runs were performed using the coating applied in the first run. The DT 6060 coatings and coating compositions are covered under U.S. 9,567,488 issued February 14, 2017, and counterpart foreign patents. Methods for forming coatings with DT 6060 are the subject of pending U.S. Patent Application No. 2017/010740 filed December 30, 2016, and published April 20, 2017.

Figure 1 shows the thermal conditions that were identical during all three consecutive runs. The temperature is linearly increased to 205 °C (400 °F) during 2150 s (~36 min) and then remains constant for 1 h (3600 s).



In Figure 2, the mass loss of the DT 6060 coating on steel as a function of heating is shown via thermogravimetric analysis (TGA). After 1150 s at 118 °C (245 °F), all

solvents used to form DT 6060 evaporated. During the remainder of run 1, isopropyl acetate emitted from the coating in the parts-per-billion (ppb) range, as shown via mass spectroscopic analysis (see Figure 3). However, no emission in ppb-range and above was detected from the DT 6060 coating during run 2 and run 3.

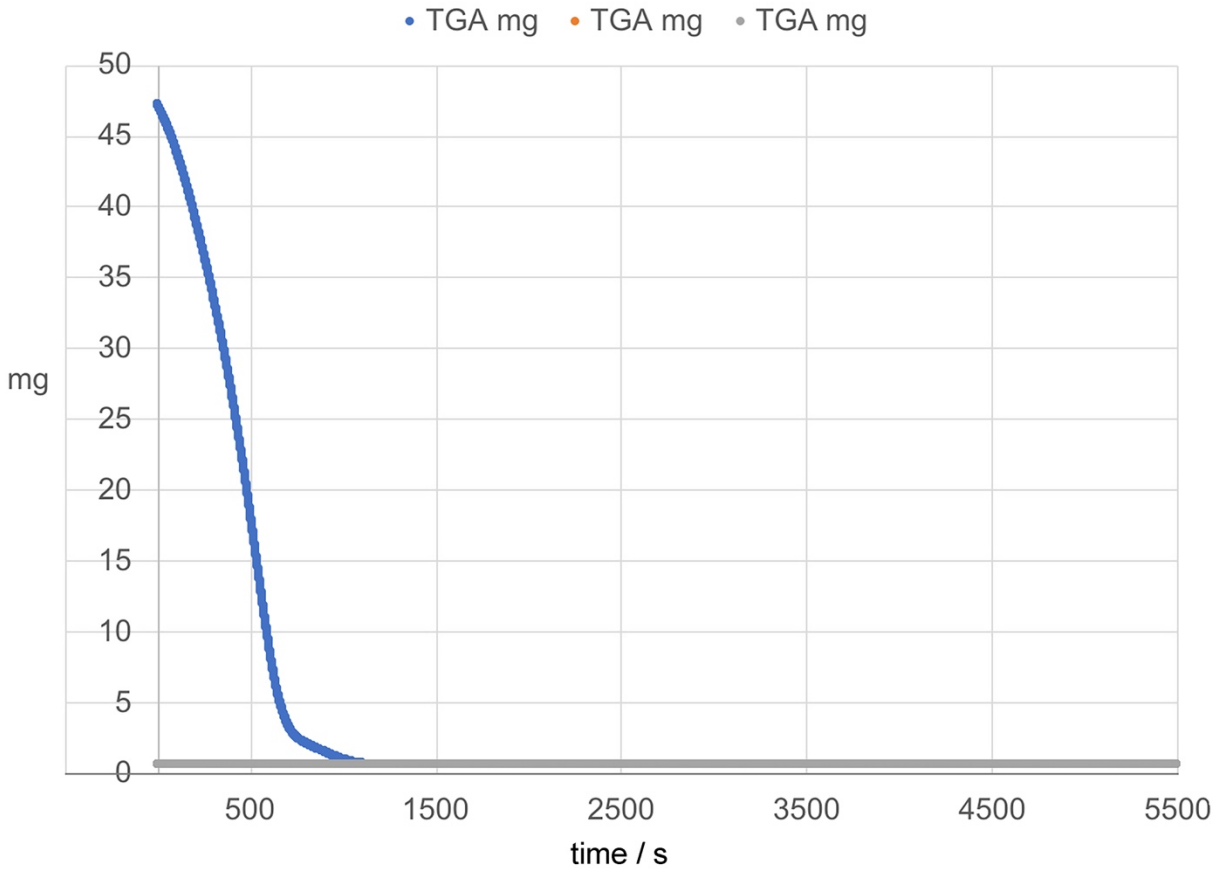


Figure 2: Thermogravimetric Analysis (TGA) of DT 6060 on steel. Three consecutive runs with the same coating were performed per the temperature profile shown in Figure 1.

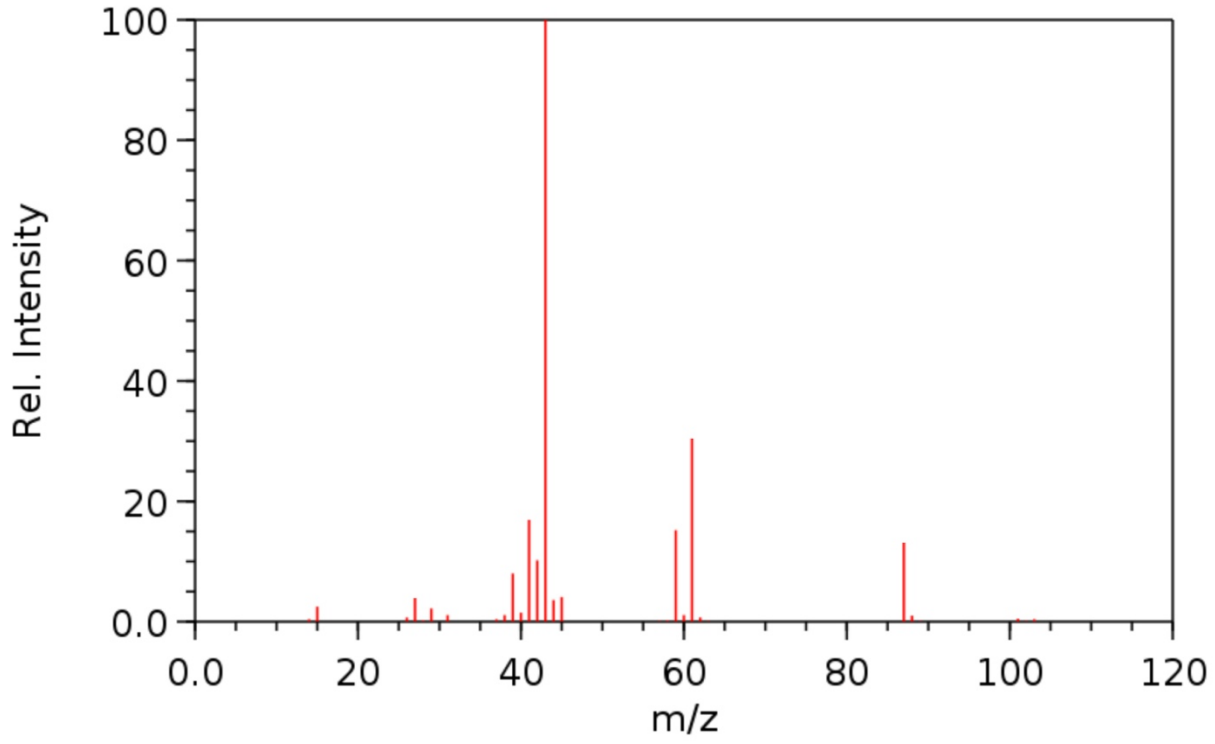


Figure 3: Mass spectrum of the gas phase above DT 6060 (run 1). The mass spectrum matched isopropyl acetate (reference: https://webbook.nist.gov/chemistry)

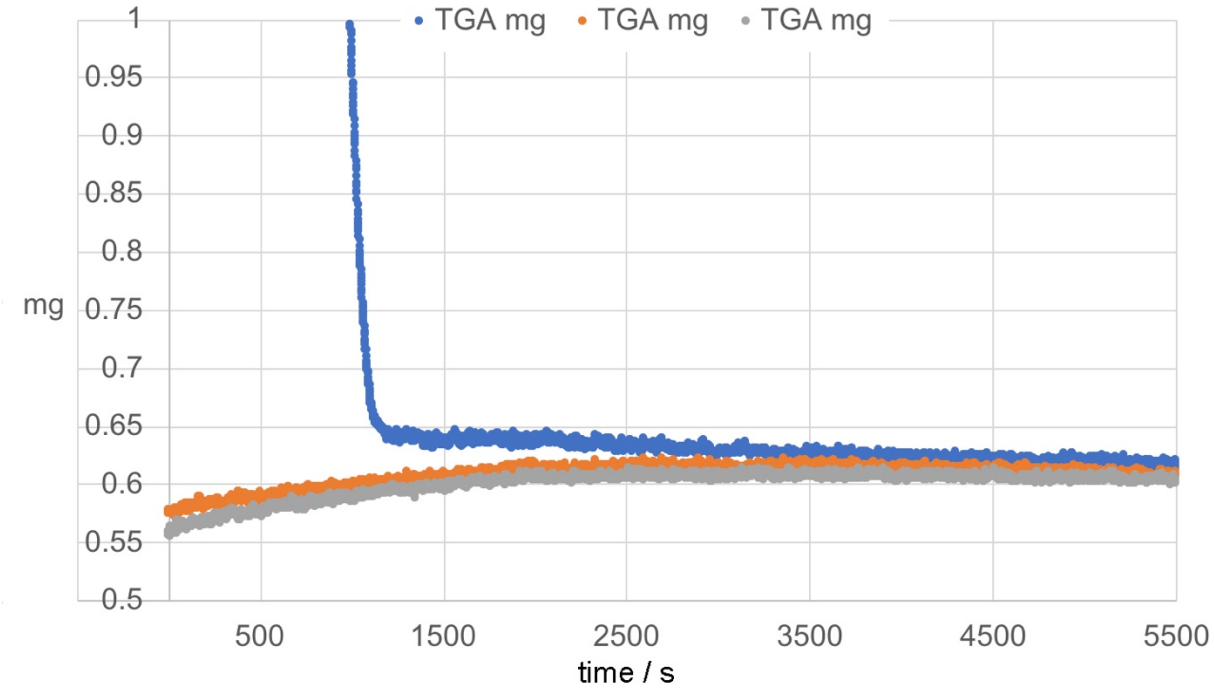


Figure 4: Thermogravimetric Analysis (TGA) of DT 6060 on steel. Three consecutive runs with the same coating were performed per the temperature profile shown in Figure

1. Figure 4 shows mass loss of the DT 6060 coating itself after deposition. The slight increase in weight during the initial phases of runs 2 and 3 are due to increased uplift during the heating-up phase.

Conclusions:

1) DT 6060 forms a thermally stable coating on steel. The DT 6060 coating lost no mass during three consecutive TGA runs after layer formation.
2) Emissions of solvents (among the n-alkanes and isopropyl acetate) were detected by mass spectroscopy during run 1. No emissions (in the ppb range or above) of solvent were detected during runs 2 and 3. No emissions of low-molecular weight silanes were observed in any run.

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