Experimental Research on Lubrication of Aluminum Injection Molds

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Abstract: This paper presents a case study carried out in order to improve the efficiency in the use of a classical release agent used to lubricate the injection moulds for aluminum alloys. The study had a commercial goal, namely to replace a release agent produced by a competitor company with a product of Chem Trend.

Keywords: release agent, aluminum injection mould.

1. INTRODUCTION
The goal of the study is to prove the superiority of a release agent manufactured by Chem Trend, so that the benefits of its use and an increased productivity would represent decisive arguments for its utilization. The test was conducted in the company CIE Automotive Târgu Mureş, and the analysis has focused on improving the injection process of the most problematic cast part at that moment. The item “Main Housing” (Fig. 1) was chosen, this part is in fact is the housing for a servo-steering mechanism manufactured by the company CIE Automotive for a leading European car manufacturer. The expectation was to obtain a low level of porosity and no metallization in the areas to be processed, with minimum allowance, in order to obtain the necessary dimensions for mounting of bearings.

2. OBJECTIVES
• To carry out a long-term industrial test, to verify the incidence of the Chem Trend SL 7824 release agent upon the specific CIE Matricon production process, to reduce the concentration of the releasing emulsion (target 1%);
• To prove the proper functioning of the SL 7824 release agent at higher temperatures than the release agent which is currently in use;
• To optimize of the production cycle, to increase productivity.

3. PREMISES
• In the current manufacturing process is used an emulsion of a competitor product release agent, with a 1.3% concentration (set up: 1.3%, actually measured with a LaMotte colorimeter: 1.45%).
• The first test, performed in the period 17-20.09.2013, proved the compatibility of the Chem Trend SL 7824 release agent with the production realities of CIE Matricon and it allowed a reduction in concentration to 1.15% (set up: 1.1%, actually measured with a LaMotte colorimeter: 1.15%) thus obtaining an initial economy of 20.7%;
• Quantity of release agent available for the test: 4000 litres;
• Estimated duration of the test: 24.02 – 27.03.2014.

4. CONDUCTING THE TEST
4.1 Verification of efficiency, reducing concentration
• At the beginning of the test, in order to form the film specific for the Chem Trend SL 7824 release agent, a 1.5% concentration established (set up: 1.5%, actually measured with a LaMotte colorimeter: 1.56%). After 3 hours of sedimentation of the active substance on the surface of the mould, the concentration was decreased to 1.3% (set up: 1.3%, actually measured with a LaMotte colorimeter: 1.29%).
• At the same lower concentration, as in the case of the competition’s release agent, the parts manufactured with the Chem Trend SL 7824 release agent have a shinier appearance, thus having a good lubrication capacity and ensuring an easy separation of the casting from the mould. No other sounds/noises were reported that would indicate difficulty in the extraction.
• As a consequence, on 27.02.2014 morning, the concentration was progressively lowered to 1% (set up: 1%, actually measured with a LaMotte colorimeter: 0.97%).
• Castings have the same glossy appearance, no difficulties during extraction.
• During the visit from 10.03.2014, we found out that the concentration settings are the same as used on 02/27/2014. The technical staff of CIE Matricon did not report any extraction related problems.

4.2 Operation at high temperatures
• At the request of the company, the analysis was performed on the cast part Main Housing, considered as the critical part at that moment, mould 3, two cavities, cell 23, 750 t press.
With the competitor’s release agent, the production cycle was:
- 12 sec. lubrication time
- 18 sec. drying time

With the Chem Trend SL 7824 release agent, the following changes were proposed:
- 10 sec. lubrication time
- 13 sec. drying time

After the thermo graphic analysis it was established that:

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**Competitor product**

Mobile side after extraction of the part, before lubrication

![Competitor product](image1)

Mobile side after lubrication, before closing

![Competitor product](image2)

**Chem Trend SL 7824**

Fix side after extraction of the part, before lubrication

![Chem Trend SL 7824](image3)

Fix side after lubrication, before closing

![Chem Trend SL 7824](image4)
The SL 7824 Chem Trend release agent allows the production cycle at a higher temperature. Thus, in the moment of mould opening (Fig. 2), the temperatures are higher, on average by 15-20 °C, and in the moment of closing the mould, after the lubrication (Fig. 3), the temperatures are higher by 25-30 °C compared to cycle with the competitor release agent.

This allows a better fluidity of the aluminium alloy during filling of the mould, thus a lower porosity of the parts is achieved. During the second day of manufacturing with the new set of parameters, the representatives of the quality assurance department confirmed an improved quality of the parts in terms of porosity.

4.3 Increased Productivity
- Based on the standard production cycle with the competitor release agent, the goal was to increase productivity by reducing the lubrication and drying times.
- The use of the Trend Chem SL 7824 release agent, and by making adjustments in the number and position of the spraying nozzles (Fig. 4) has allowed a reduction in the time of an injection cycle by 7 seconds.
- By reducing the time of an injection cycle by 7 seconds, productivity increases by 10.3%.

5. CONCLUSIONS
- Tests have shown that the Chem Trend 7824 SL release agent fulfills all the requirements set by the management CIE Maticon company:
  - possibility of using a lower concentration of only 1%, resulting in an economy of 23% according to the settings of the dosimeter, and an economy of 31% actually measured with LaMotte colorimeter;
  - possibility of carrying out the casting process at higher temperatures;
  - productivity can be increased by 10.3% in the case of the product that presented problems at the time of testing.
- In addition to the described advantages, Chem Trend products also ensure a good continuity of the injection process, as well as a reduction of the total cost of manufacturing by:
  - use of smaller quantities of release agents and auxiliary materials;
  - improved product quality;
  - reducing the consumption of compressed air and electricity;
  - reducing the costs with waste materials treatment.

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