

## DePuy Synthes kpi-dry™ Case Study

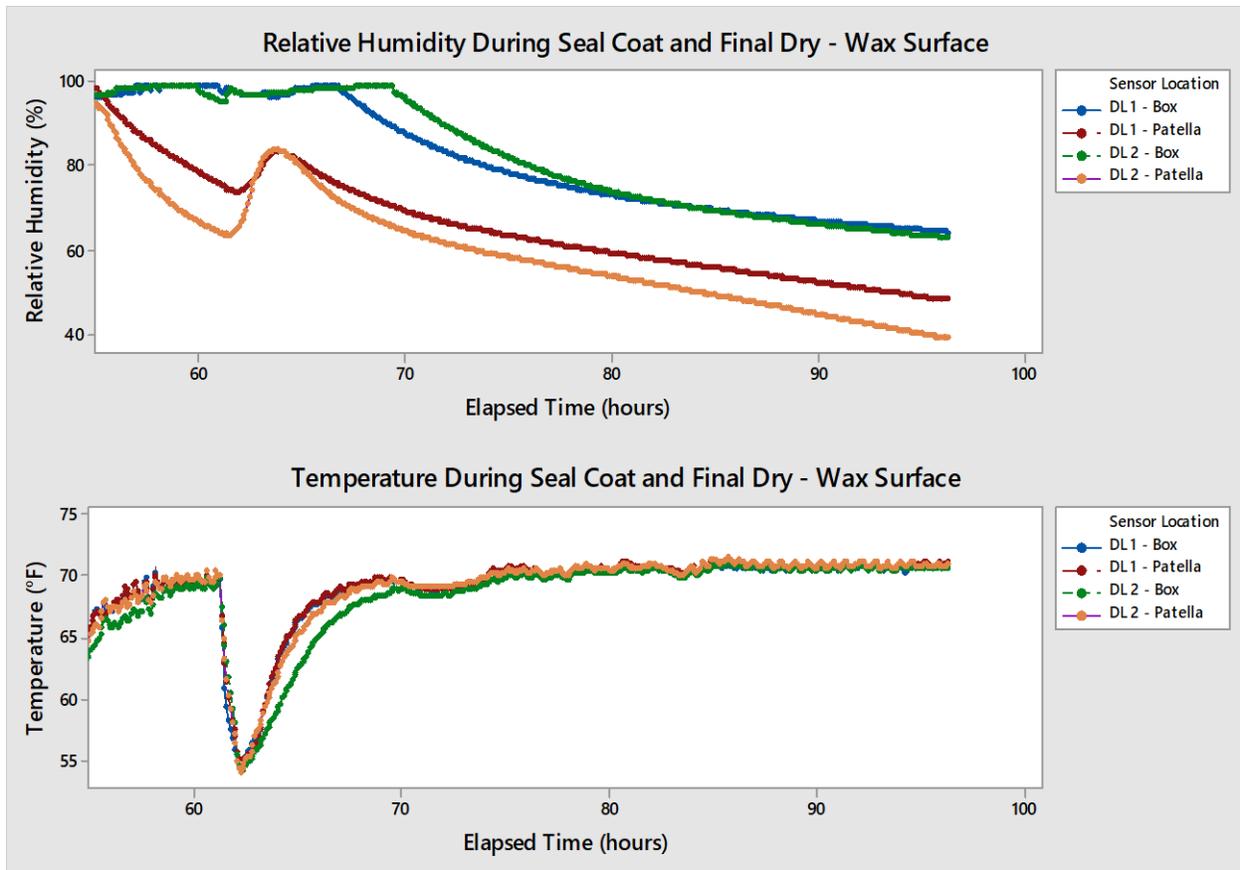
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Johnson and Johnson's DePuy Synthes Raynham branch foundry manufactures castings of knee and hip replacement product parts. Within the shell dry room there are 176 hangers with 47 of them allocated to final dry. This configuration creates a bottleneck which limits the overall capacity of the room. In order to address this bottleneck, a project has been undertaken to reduce the minimum dry time specification within the final dry room.

While the molds appear to be dry, DePuy was looking for a way to measure mold dryness and correlate it to casting quality. After discussing with Key Process Innovations, DePuy decided to use the kpi-dry™ unit as the method for measuring the dryness of the molds. If the data from multiple trials shows consistent duration to reach a target relative humidity (RH) value and constant temperature, then the data can be used to support a change in dry time specification.

DePuy purchased two data loggers to support four sensors per trial. Two locations on the mold suspected to be best-case scenarios and two locations suspected to be worst-case scenarios, in terms of ease of drying, were chosen. The best-case location was defined as the patella because it is subject to the most airflow. The worst-case location was defined as the box because it is subject to the least amount of airflow.

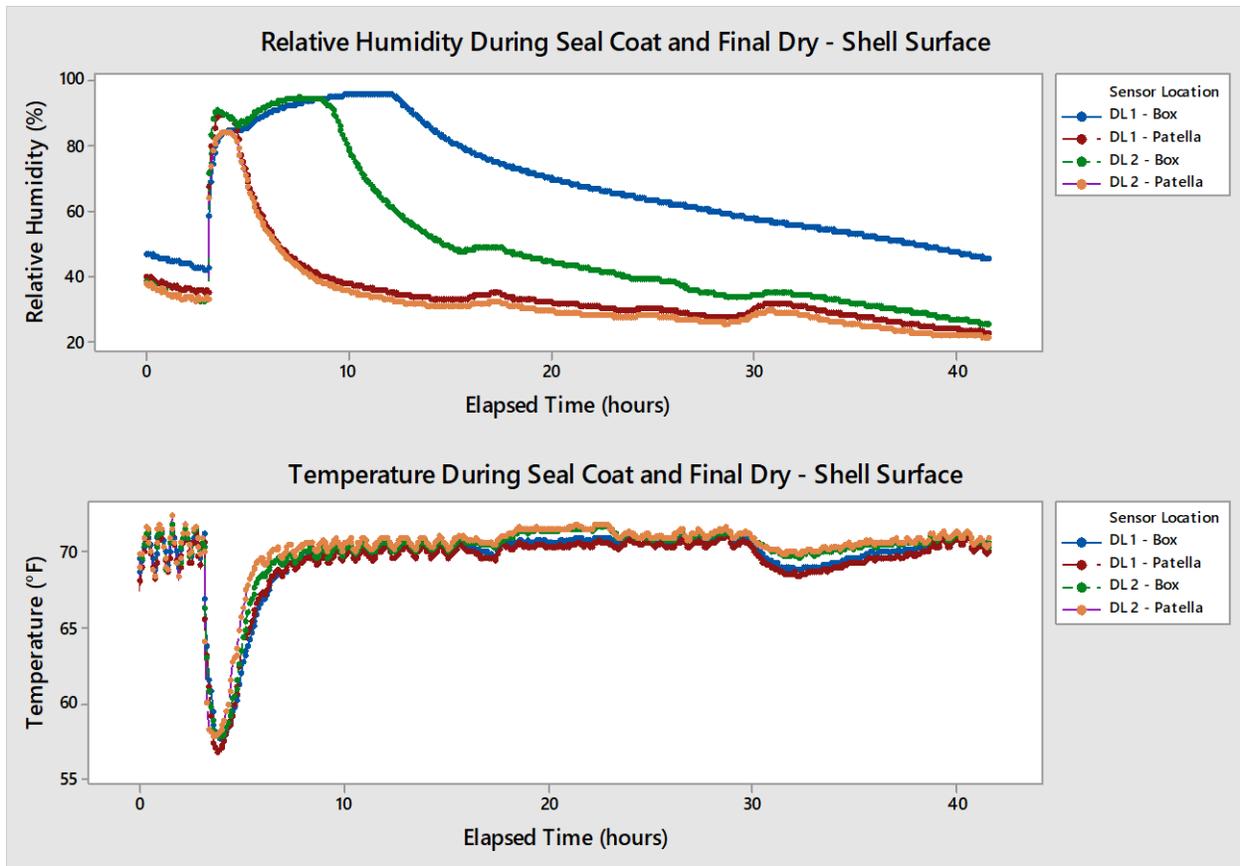
The first hypothesis was that if the mold is dry at the interface with the wax surface, then it is dry and ready to move on to autoclave. The four sensors were placed on the wax surface at the best-case and worst-case drying locations for two parts.



**Figure 1.** The relative humidity and temperature readings at the wax surface during and after the application of the final coat of slurry.

From previous kpi-dry studies, a relative humidity target of 65% was considered adequate dryness prior to applying subsequent coats. These results show that the box nearly reaches this target after about 30 hours, which significantly exceeds the minimum dry time specification for this particular part. Even at the patella, only one of the two molds reached the 65% target by the minimum dry time. Temperature became constant by the time of the dry time specification.

Since DePuy has a history of making quality castings with current dry time specifications, this suggests that having a target value of 65% RH at the wax surface may not be necessary. So for the next trial, measurements were taken at the shell surface. The same locations were used, with four sensors total.



**Figure 2.** The relative humidity and temperature readings at the shell surface during and after the application of the final coat of slurry.

The results from this trial show that the shell surface dries a lot faster than the wax surface. The patella locations reach the target RH value well before the minimum dry time specification. One of the box locations also reached the target RH value before the minimum dry time specification. Interestingly enough, the other box location took a lot longer to dry and did not reach 65% RH before the specification. More trials will need to be done to investigate the discrepancy between the RH trends at the two box locations. The temperature trend at the shell surface was consistent with that of the wax surface, but stabilized faster, as expected, because it was exposed to the air.

The data gathered to date provides helpful information on how the shell is drying in various locations on the mold. However, no conclusions can be made thus far to reduce the dry time specification at DePuy. Further testing will be conducted and compared against casting quality. If a relationship can be made between casting quality and the RH trends, there may be a tool which can be utilized to reduce final dry time at the DePuy foundry.