LX-14 PRESSING STUDIES

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DEVELOPMENT DIVISION

MASTER

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*Normal Process Development
Endeavor No. 105*

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ABSTRACT

Bartherm is a post-pressing process that can be used to increase the density of PBX parts. The process also reduces the variation of density within the part. The density of a large pressing of LX-14 (138 kg as-machined) was increased by 12 kg/m^3 with a reduction of density spread from 12 kg/m^3 to 6 kg/m^3 . Bartherm is available as an "on-the-shelf" process, although expensive, for producing a uniform high density in large pressings of LX-14.

DISCUSSION

Two hemispherical pressings were made of LX-14, Holston production Lot 713-1, using the same process. The PBX material was preheated to 124°C , incrementally loaded, and partly compacted (3 times) in the 762 mm diameter Elmes press until the full charge of approximately 170 kg was in place. Final compaction to form the pressings was at 140 MPa for a 10 minute dwell, the final as-pressed piece being 670 mm diameter x 410 mm high. Both pressings were machined to generate smooth surfaces so an accurate as-pressed density could be measured. The final weight was approximately 138 kg.

One of the above pressings was used as the test control; i.e., no further process pressing was done. A slab was machine-sawed from the center of the pressing, located such that a pattern of cores could be machined from one face of the slab and the piece centerline would be included in the core samples. The density of these cores formed the basis of the contoured areas of Fig. 1.

The other pressing was used to evaluate the Bartherm process. The pressing was completely submerged in a water-filled pressure vessel. The vessel was sealed and heated 24 hours to bring the temperature to 71°C . The Bartherm process period was considered to start when the now heated system was pressurized to 1.72 MPa. This condition of heat and pressure was maintained full-time for seven consecutive days. Pressure was maintained for two more days as the vessel was allowed to cool by natural conductive heat loss.

Below is a bar graph of the process used.

The barthermed pressing was sectioned and cored in the same manner described for the control piece. The contour areas of Fig. 2 were derived from the core data.

The contour areas of Figs. 1 and 2 represent only the relative density within that part according to the process treatment history when the cores were machined. The barthermed piece density was increased 12 kg/m³, but only the spread of density is evident in Fig. 2. The contour areas represent high, low and normal density, the normal density being defined in this test as "average $\pm$ 1 kg/m³." This is a rather tight grouping but if it were enlarged the density changes would not be obvious. The outlines shown are not absolute, but represent slight compromises left to right, with more credence being given to the data with the smallest standard deviation. It is assumed that the patterns represented in the sample slab would continue for a full rotation.

Considering the areas in Figs. 1 and 2 that represent each density; the average area in the barthermed piece is larger by a factor of almost three. The various density areas, by percentage are:

	Standard Process (%)	Barthermed Process (%)
High Density	44	20
Average Density	22	64
Low Density	34	16

CONCLUSIONS

The Bartherm process is available to increase PBX density and reduce the spread of density within that part. The process is slow, requiring ten days in this test, but this may be worth the time and expense if parts of maximum quality are required for testing or other unusual reasons.

FUTURE WORK

The requirement for these massive pressings is limited at this time, and no further investigations are planned with LX-14.

Fig. 1. Standard Compaction Process

Fig. 2. Bartherm Post-Pressing Process