Extruding in a Reset Market

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A New Standard is Set: Following the recent economic meltdown, our economy, our productivity, and our entire lifestyle are all in the process of being reset. The light metal extrusion industry can't ignore this fact. We must accept it and adjust to a new and much more challenging business environment for the foreseeable future.

In the past, for example, relatively few exemplary extruders were active in the automotive market because the automotive industry has traditionally been so exacting that few extruders could profitably satisfy its requirements. Extruders are now faced with the fact that yesterday's automotive standard has become today's survival standard. Competition between extruders has suddenly become intense. Coincidentally, however the evolution of light metal extrusion is changing exponentially. The extruders who make best use of some of the new technology will undoubtedly increase their share of the available market. As the market becomes aware of what really can be done by extruders, and at a bargain price, yesterday's exception must become today's norm.

Evolution of Extrusion: Over time, there have been several key events in the evolution of the extrusion process, most of which occurred in the past 20 years. The first was likely the introduction of CNC wire EDM cutting, and the use of numerical control in milling and turning dies. This not only made dies much more accurate and repeatable, but also much less labor intensive. Second, of course, was the change from loose to fixed dummy blocks. The third major event was the long overdue introduction of the single cell die oven. Previously, the first one or two billets in each run were usually required to properly heat the die.

Next came the smart, or PLC driven, quick response container. It is likely the most significant innovation in light metal extrusion since the fixed dummy block and the single cell die oven. It has been found that since the thermal mass of the container is so much greater than that of the die, as soon as it is clamped in place, the die assumes the same temperature as the end of the liner. The quick response container is therefore designed to quickly correct temperature variations by heating the container liner instead of the container mantle. In fact, the ultimate purpose of the contemporary container is actually to control the die temperature during the extrusion process.

Finally, a component that makes a real contribution to a better product, but is often overlooked, is the quench. A new PLC controlled cooling quench is now in the final stages of development and field trials, and will shortly be on the market. Each cooling zone will use the latest technology in nozzles, allowing air, mist, and flooding from top, bottom, or each side, depending on the requirements of the profile. These requirements include shape, weight per foot, surface area, type of alloy, speed, and function. The function determines the mechanical properties required. An extruder will be able to control the air pressure and water flow going to each manifold, and therefore the precise rate of cooling.

Visual Optimizer: Every extrusion production process can be improved. There are no exceptions. Few other mature industries exist where even world-class recovery and productivity is so far below optimal parameters.

Better extrusion is done by better extruders, not just better equipment. They are challenged, however, by the number of constantly changing variables in the extrusion production system. Because light metal extrusion is a process in which components interact closely, and temperatures continually change, the number of combinations and permutations that can occur at any point in time is virtually infinite. If, however, the press operator can know the temperatures at several critical areas during the extrusion cycle, plus the ram speed, he can positively control the process while the press is running. This makes it possible to operate considerably closer to optimum productivity. Recent advances in the technology of ultra-accurate remote temperature measurement, plus the introduction of computer-controlled smart containers, has made possible the development of a visual optimizer, the best tool yet devised to assist the extruder in improving his productivity.

Recipe For Success: Initially, the operator is given the press, profile, die, and type of alloy. From this information, using his experience and talent, he can prepare an initial recipe for production for use with the die. This will include all necessary temperatures, ram speed, dead cycle time, etc. that he can instantly and positively control, and that will safely produce saleable product.

Monitoring the Process: At the operators post, above the press, a large backlit monitor screen shows the actual temperature or speed at each point being monitored, plus the target from a previously prepared recipe. If the actual is equal or greater than the target, it will appear in green. If not, it will be shown in red. The operator will then be able to tell at a glance how close he is to target at each point being monitored, and take whatever action is required to bring the system back on track.

The visual optimizer will be customized to fit each customer's needs and budget, but will typically include ram speed, dead cycle time, billet temperature, container liner temperature top and bottom at both entrance and exit, die temperature, profile exit temperature, quench rate, and also graphically, the temperature status of the die in each single cell die oven, i.e., time to temperature and time at temperature.

The Critical Freeze-Frame: Whenever the combination of temperatures and speeds produces a new level of productivity for the die being used, a freeze-frame automatically records all the information being monitored at that precise instant. This then becomes the new recipe for the next repeat run. Once the die has been optimized, leaner alloys can be then be tried, which can dramatically increase ram speed and productivity. The world's best extruders today consistently use extremely lean alloys, i.e. minimal magnesium and silicon. Eventually, every die will be accompanied by a current recipe.

The Future: Now that extruders can finally have the die uniformly at the right temperature on the press and a PLC-driven quench, what's the next in the evolution of light metal extrusion?

The next logical step is to optimize die design, then to use leaner alloys to allow increased speeds. Most extruders have no idea of the dramatic and immediate increase in productivity that often occurs when operating temperatures are closely controlled enough to permit leaner alloys to be used.

The following step is to automatically control an accurately calculated tapered billet temperature within +/- 5°C at all times, from when it enters the container until it exits the die, because varying ram speed is no longer an option. The longtime goal of isothermal extrusion can only be achieved with a constant ram speed. As soon as the die exit speed varies, the dimensional integrity of the section profile is compromised.

The final step is to close the loop. When this has been done, light metal extrusion will enter new markets with a superior, repeatable, and lower cost product that can be produced and sold at a profit.

Conclusion: The light metal extrusion market has been reset. It will never return to the standards of quality, service, and price that were acceptable in the past. But, the technology of the extrusion production process is rapidly improving to meet this challenge, and much better extrusion is now possible and viable. New applications must surely follow. The potential for market growth is limited only by the imagination of the design engineers.