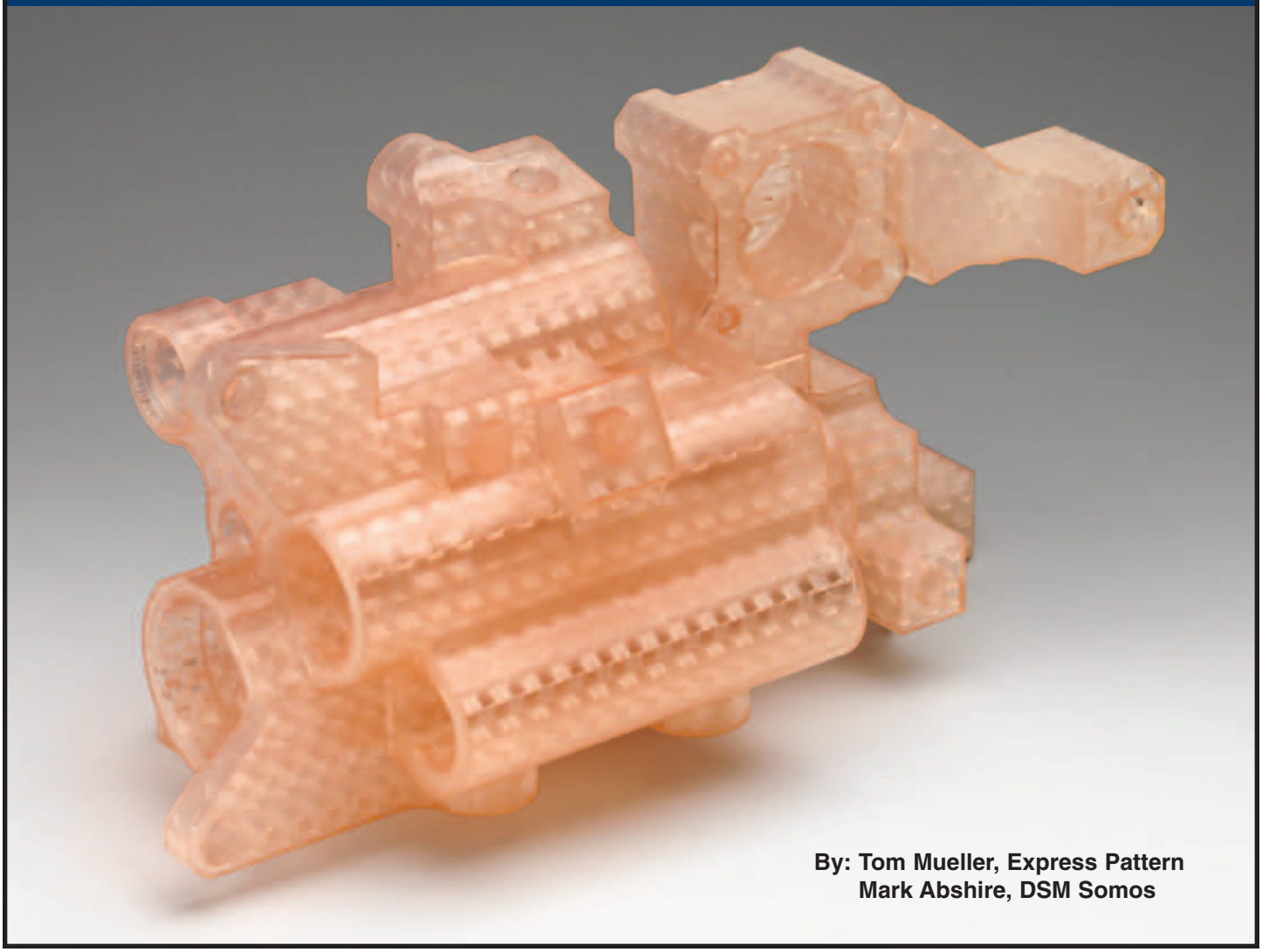
Express Pattern

DSM Somos®

Guide to Casting QuickCast™ Patterns

— 2007 Edition —



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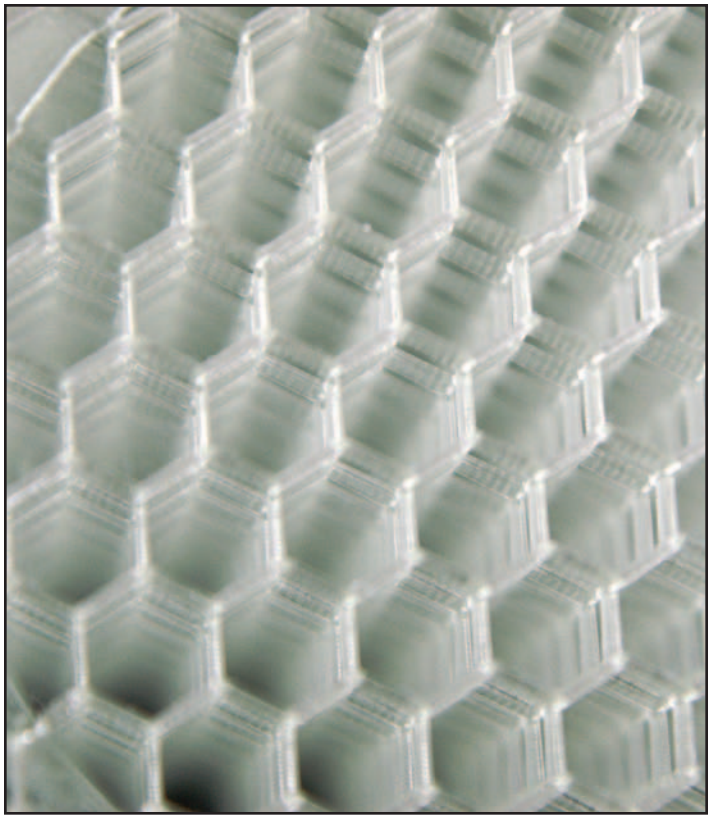
Introduction

Investment casting, also known as lost wax casting has been successful in creating near net shapes for thousands of years. While the process has significant advantages in its ability to create complex geometry with relatively tight tolerances, it requires that a tool be created to mold wax patterns. The substantial cost and time required to generate wax pattern tooling limits the range of applications for which investment casting is economically competitive.

In recent history “Direct Cast Patterns” produced with Rapid Prototyping (RP) technology has afforded the investment casting industry a boost by allowing more designs to be cast without the initial expense and time to fabricate wax pattern tooling. Direct Cast Patterns may be defined as investment casting patterns created *without the use of tooling* to create the pattern shape.

Many RP technologies are capable of creating direct cast pattern. However only Stereolithography (SL) provides the dimensional accuracy and surface finish required for the majority of production investment castings. Consequently, direct casting patterns made with stereolithography are the most common and most widely accepted in the investment casting industry. SL produces a mostly hollow style pattern with an internal honeycomb structure called “QuickCast™” (a registered trademark of 3D Systems) that can be used in place of a wax pattern. This hollow build style is important to ensure that the pattern will collapse inward during the shell burnout and prevent expansion forces from cracking the shell. The mostly hollow build style also reduces the amount of material necessary to burnout.

The most significant advancement in QuickCast technology in recent years has been the introduction in 2006 of a resin developed specifically for investment casting, the 19120 ProtoCast AF® (a registered trademark of DSM Somos). ProtoCast AF is the only SL resin available that is entirely antimony free. Antimony has traditionally been used in the photo-initiator component of SL resins. Photo-initiators are chemicals that convert the liquid resin to a solid upon exposure by an ultraviolet laser beam. While antimony is present only in very small amounts, it typically comprises the majority of the ash or oxides remaining after the pattern has been burned out. Since even trace amounts of antimony can seriously degrade material properties of a variety of alloys, its presence in ash represents a significant danger to the quality of the



casting. Using an antimony-free resin not only eliminates potential metallurgical contamination, but significantly reduces the amount of ash remaining after combustion as well.

The purpose of this guide is to assist foundries to successfully cast QuickCast patterns produced with DSM Somos19120 ProtoCast AF resin. While earlier guides from Express Pattern and 3D Systems (by the authors of this guide) provided general recommendations, recent improvements in both SL technology and SL resins have made it possible to minimize the number of specialized processing steps required to successfully cast QuickCast patterns. This guide includes the most recent information on processing QuickCast patterns and will be updated frequently as new information becomes available. Please note that the recommendations put forth in this document are guidelines and may need to be modified by the individual foundry based on their processes and equipment.

This guide is organized into four main sections:

1. **Part 1: Obtaining the Pattern –** The vast majority of investment foundries do not own SL equipment. Consequently, the foundry must either source the pattern from one of the many service providers, or allow the customer to supply the pattern. Most foundries prefer to source the pattern themselves since they will be held responsible for the quality of the casting and therefore want to control the quality of the pattern. This section provides information to help you obtain a quality pattern.

2. **Part 2: Pattern Assembly –** While assembling a QuickCast pattern is very similar to working with wax patterns, there are some important differences. This section will provide a step by step guide to creating a successful tree.

3. **Part 3: Shell Building –** Building a shell using QuickCast patterns is very similar to that for wax patterns, but again, there are a few important differences. This section helps you to avoid possible pitfalls.

4. **Part 4: Pattern Removal –** This section describes the steps necessary to remove patterns, sprues, gates and runners from the shell and prepare it for pouring. It is in this step that processing QuickCast patterns differs most from processing wax patterns and where most failures occur. This section will help you to successfully de-wax shells with a minimum of differences from the methods used for wax patterns.

In addition, there are four appendices that provide additional useful information.

If you have any questions or suggestions for improvements to the guide, please contact the authors, DSM Somos, or Express Pattern.

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