Lustrous carbon defects generally occur in iron castings made using urethane bonded sands, shell molds, expanded polystyrene (EPS) molds or green sand molds. Also known as resin, kish or soot, they often appear as adherent, shiny “wrinkled” deposits of carbon resembling alligator skin on or just under the surface formed by the cope mold or top of the core.

Carbon-Rich Gases

While the exact nature of the mechanism that forms lustrous carbon is not completely apparent, defect formation and severity are caused by three primary factors: pouring time, temperature and turbulence; organic volatile gas content; and mold/core composition and permeability.

The most important cause of lustrous carbon is the presence of high levels of volatile gases trapped at the mold or core surface. These gases are the hydrocarbon breakdown product of organic binders—especially urethane-based cold-set and shell mold systems—released during pouring as the metal comes in contact with the mold or core surface.

The carbon-rich gases condense as a very thin film or sheet of graphite flushed ahead of the leading edge of the incoming stream of metal in the mold. There is a tendency for the defects to form along the edges of the first metal streams in the ingates.

Defect Formation

In lesser amounts, the carbonaceous materials in the gases are actually beneficial. They provide a reducing atmosphere blanket against the casting surface in the mold, which minimizes surface oxidation and improves surface quality, or “peel.” Often, they can be easily removed from the casting surface by regular cleaning operations.

As the level of volatile gases increases, however, the severity of the defect also increases, and the lustrous carbon folds into solidifying metal, causing unacceptable cold shuts and laps. These occurrences also affect microstructure, creating differences in graphite formation in the layers created by the defect.

Defect Control

Foundrymen can take several steps to control the frequency and severity of lustrous carbon defects. These include:

- lowering the binder content in urethane-bonded systems, especially the isocyanate component of the binder;
- increasing the mechanical venting and permeability of the core and mold;
- increasing pouring temperature—hotter metal tends to dissolve the carbonaceous material;
- reducing the fill time and pouring turbulence;
- applying a low-carbon coating to the core and/or mold surface;
- adding 0.5%-1% oxidizing materials (iron oxide, for example) to the core sand.

As with any process control, correcting lustrous carbon defects requires careful attention to all variables and relevant foundry practices. Comprehensive testing should lead to a reduction in frequency and severity of the defect.