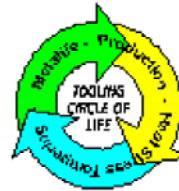


# ◆ MetalLife®



## MUST READ NEWS

**Volume 5 Issue 1    Substrate Preparation & Surface Treatments    February 1999**

**Badger Metal Tech, Inc.** N60 W15088 Bobolink Ave. Menomonee Falls, WI 53051 414-252-3804 FAX 414-252-3956  
TOLL FREE in the US and Canada - 800-366-1973 — **WEBSITE - badgermetals.com - published 02/19/99**



As we stand at the threshold awaiting our entry to the year 2000, it is exciting to note that die casting has evolved to become more of a science and art than it was 15 years ago. In conjunction with this, proactive and preventative die maintenance practices and procedures involving coatings, platings, and diffusion processes are becoming more common practice. These along with welding repair and periodic heat stress tempering have contributed to significant increased die life and improved die performance. Because of the many choices, some confusion exists as to what treatment or treatments should be performed to attain a desired goal and how should they be applied and in what order. We will answer most of these questions in this newsletter and show the importance of the inclusion of the validated **MetalLife®** process with or without these treatments.

**Welding** a die is sometimes necessary to correct large cracking or actual metal breakout and should be done in accordance to the NADCA guide "Recommended Procedures for H-13" ...207.97. The welding process is similar to EDM in that both produce a heat affected zone and white cast layer. While EDM can leave a layer that is .0005" to .0015" in depth, the depth of a welded zone can be anywhere from .25" to several inches in depth. Large tensile stresses develop as the molten weld cools and tries to shrink but cannot due to the resistance of the cooler and stronger base material. These detrimental tensile stresses must be transformed if the welding process is to be successful. For this reason **MetalLife** is commonly applied to welded and virgin metal die areas after post stress tempering. If porosity exists in the welded area, **MetalLife** will show these areas immediately so they may be corrected prior to placing the die back in service. Although the welded area is usually much harder than the base metal, and has less texturing after **MetalLife**, this does not prevent creation of the needed compressive stress. This appears to be contrary to what one might reason, however, harder surfaces yield less, resulting in more direct energy transfer thus allowing higher levels of compression both at the surface and at maximum depth.

stress. Even though **MetalLife** cannot close up heat checks a nitrided or case hardened surface, it does generate a significant additive compressive stress layer that helps the tooling be more resistant to subsequent heat checking. This benefit applies to both NEW and USED tooling.

Since compressive stresses can be somewhat or totally relieved by penetrating high heat or extended high heat conditions, it is recommended that **MetalLife** be done after heat stress tempering. This is also true for surface treatments such as Chemical Vapor Deposition (CVD) coatings that are done at or close to the austenitizing temperature of the steel.

Physical Vapor Deposition (PVD) low temperature coatings when deposited create a columnar structure perpendicular to the base surface. Coatings that crack open paths to the unprotected substrates which also crack, causing both the coating and substrate to fail. It is, therefore, important to properly prepare the substrate for any subsequent application of a coating. An additive **MetalLife** compressive layer in the substrate cannot allow cracking unless the tensile stresses at the base of the coating crack are greater than the compressive stress. As since **MetalLife** is inert, by its nature, the subsequently applied coating is not compromised. The texturing of the dies surface also helps give better adhesion characteristics to the coating.

Surface treatments that are more malleable and ductile may **MetalLife** processed either before or after treating provided application temperatures are not so high as to relieve all compressive stresses. There are two schools of thought on what should be applied first and is usually dependent on the condition of the tool. For heat checked tooling, it is best to first apply **MetalLife** to close the cracks as much as possible then apply the treatment. For NEW tooling, apply the treatment first then **MetalLife**. These recommendations, up to this date, are based solely on successful field test results. Badger is conducting tests on one of these treatments to see how the applied heat during treatment affects the compressive stress.

## 1999-02 Residual Stress Measurements

Thus same principle applies to various types of **nitrided** surfaces. The diffusion action of the nitrogen into the metal's surface stretches it slightly which creates a thin layer of compressive

els. We will be reporting on this in future newsletters. If you would like more information on how each of these coating treatments fall into specific categories, please call us.

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