



COMPRESSIVE STRESS TEXTURING

**DIE SURFACE TREATMENT
FOR**

DRAWING
FORMING
PIERCING
COLD HEADING

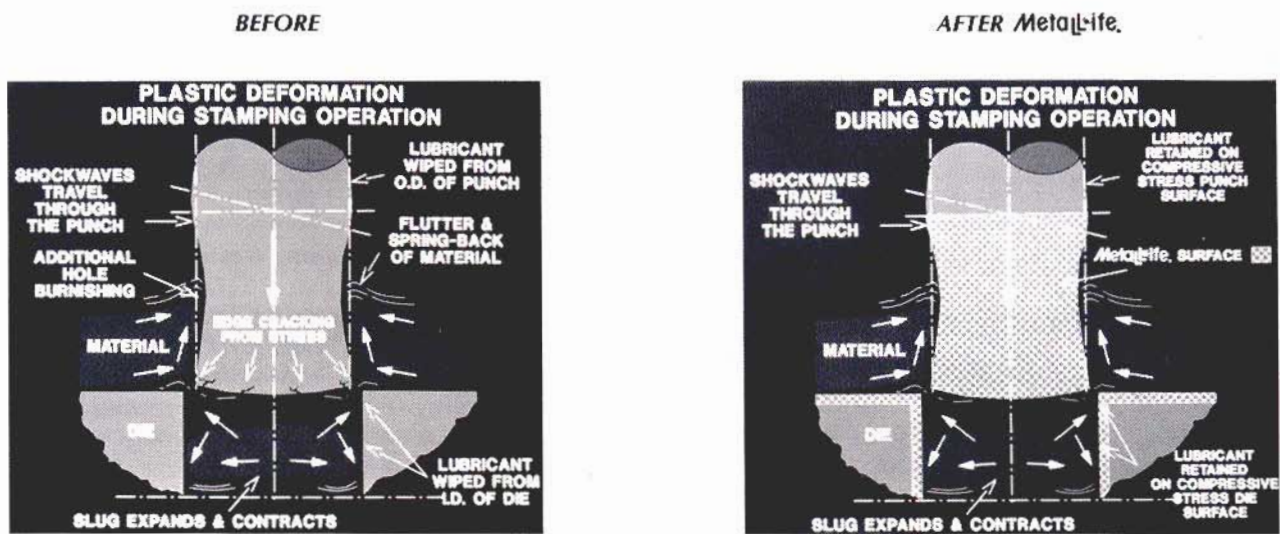
SWAGING
BLANKING
EXTRUDING
FINE BLANKING

***IMPROVED PERFORMANCE
&
EXTENDED LIFE
WITHOUT COATING THE SURFACE***

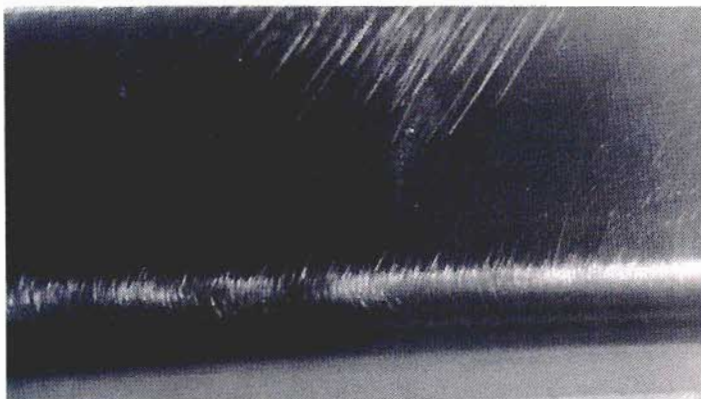
WHAT IS IT?

MetaLife is an ambient mechanical **compressive stress** texturing surface treatment. Application of this proprietary process involves impaction of the working tool surface area with special media under rigid control criteria that causes a kinetic energy transfer. This energy transfer converts the residual tensile stresses left after Electrical Discharge Machining, finish machining, and grinding to beneficial compressive stress. The compressive stress layer has a sub-surface penetration of .010" to .015" of an inch on dies that have not been nitrided or previously surface coated or plated and whose Rockwell is between 40-65 on the "C" scale. The compressive stress and cold working effect raises the effective yield strength on the average of 25% to 30%. The process is selective and need only be applied to the working area of the tool.

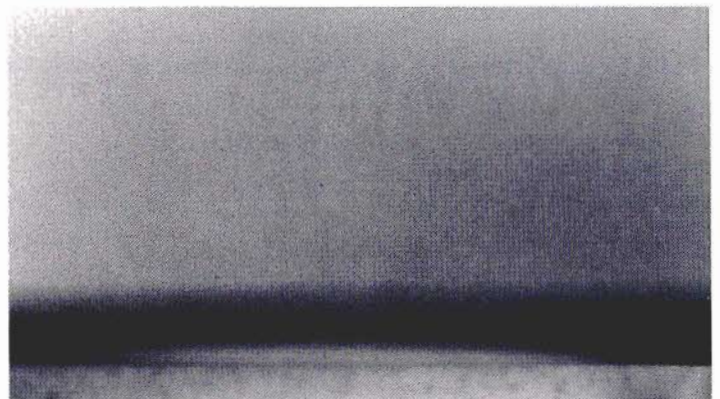
STOPS CRACK PROPAGATION . . . A well known principle of metallurgy states that crack propagation cannot occur in a compressively stressed zone unless the effective yield strength of the steel is exceeded. Cracks start at the surface. If a surface is in compression, stress cracking cannot start or propagate further unless stressed beyond this newly raised effective yield strength. The **MetaLife** surface depth also allows some subsequent polishing of the tool without the loss of the lubricity or the compressive stress benefits.



REMOVES SURFACE INCLUSIONS . . . Small surface inclusions that are left after finish machining, grinding, and polishing are obliterated. During the course of die use, these small surface inclusions combine with the normal oxidation of the surface and begin to trap and hold metal from the formed/blanked material. The continued use of the die causes a wedging action which causes more metal to be deposited until the die develops a galling problem. Sometimes this wedging action can become so pronounced that the tool cracks. **MetaLife** seals and removes these small surface inclusions and oxides that compromise the tool's initial integrity and lead to galling and die cracking.



A macro photo of a rail die surface shows numerous surface inclusions left after finish grinding and polishing.



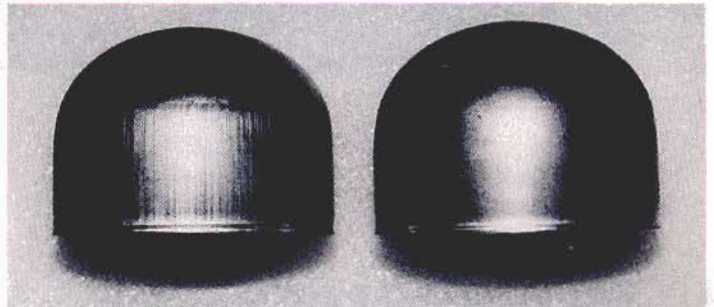
The MetaLife surface is inclusion free with all of the grind and polish marks obliterated.

MetaLife®

COMPRESSIVE STRESS TEXTURING

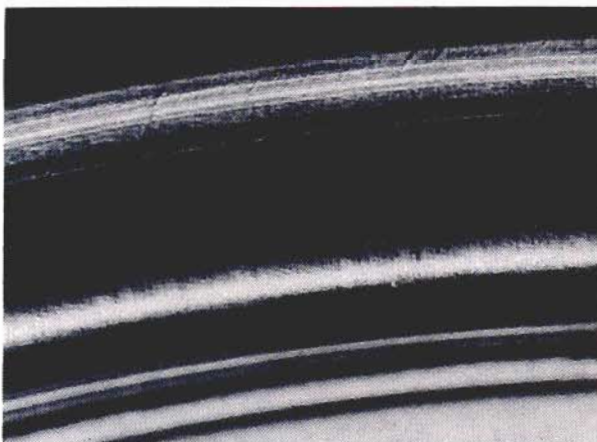
A REAL ANSWER

Today's demand for ever increasing manufacturing productivity requires drawing/forming/blanking dies to perform in an exceptional manner. Unfortunately galling of a drawing/forming/extruding/swagging tool or breakdown of the cutting edge of a fine blanking/piercing tool can have a serious limiting effect on this performance. Most solutions to the problem of galling and edge breakdown only consider coating or plating the tool surface which do not take into consideration the substrate surface. Now there is a PROVEN surface treatment for drawing/forming/blanking tooling that will help solve most of these ever present problems by actually changing the stress profile of the tooling surface.



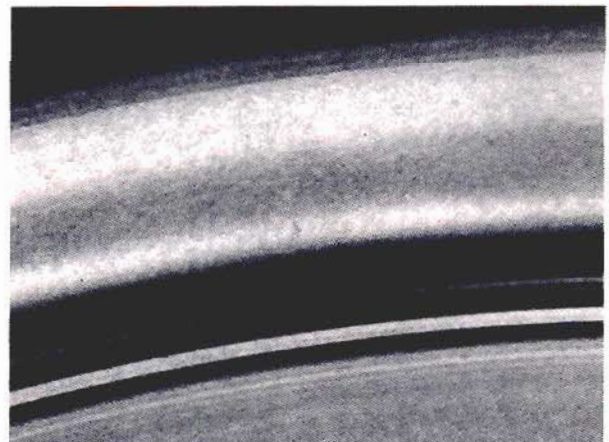
On the left is the 400th part produced from an unprocessed die. Note the galling and scoring of the part. On the right is the 8,390th part produced from a processed die. Note the absence of gall marks and improved surface finish.

Not a coating, plating or chemical bath, this proprietary surface treatment can be applied not only to new tooling but also to tooling that has been refurbished. The process has the ability to retard the tendency of edge breakdown of cutting surfaces and to significantly improve the lubricity of drawing and forming dies. It closes and eliminates small surface inclusions that remain after finish machining, grinding, and polishing that cause galling. There is no compromise to the initial heat treat of the die and it can be reapplied, if necessary, without affecting the weldability or machinability of the die. More than just a cosmetic surface treatment, **MetaLife** actually changes the stress profile of the die surface while raising the effective yield strength of the tool without changing tool tolerances. The higher effective yield strength significantly retards the micro cracking of a blanking or cutting tool's edge and stops the propagation of further cracking of the tool's primary contact surface. **MetaLife** has been tested in the lab and field tested for over six years.



BEFORE

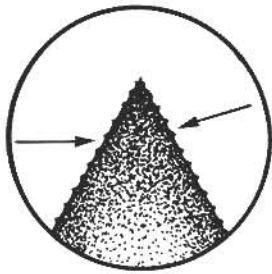
A macro photo of a die section showing surface inclusions and polish marks that contribute to galling, pick-up, and stress cracking.



AFTER

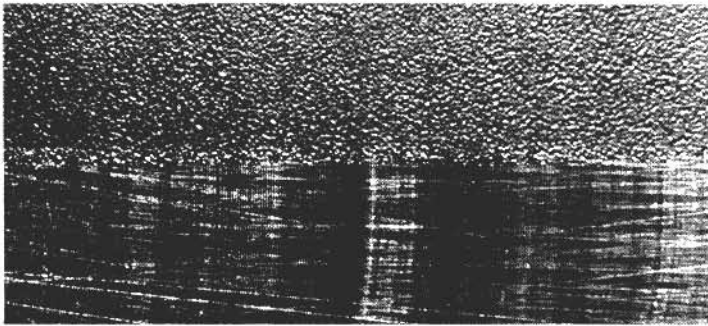
The same die section after MetaLife shows a textured surface, free of inclusions and polish marks, which has an improved affinity to retain lubricant.

At the moment of impaction to the tempered die steel surface, there is a plastic flow of material. This action is what closes and obliterates the minor surface inclusions on the die's surface. After processing, the die surface is left in a micro textured state because of this action. This **texturing**, along with the inherent compressive stress layer, contributes to the improved performance of the die to provide other significant benefits in addition to retarding cracking and galling.



Cross Section Diagram with pocketed surface texture which retains lubricant and increases working surface area of the die.

MACRO PHOTO OF DIE



The top portion of this die surface was MetalLife, processed. This micro pocketed surface aids lubricant retention.

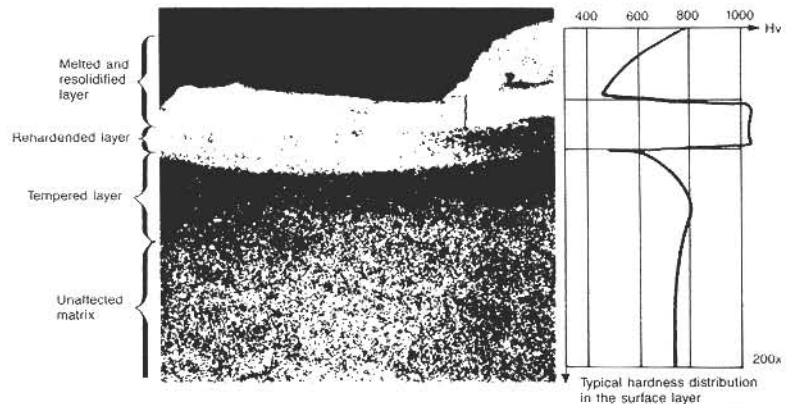
BETTER HEAT DISSIPATION . . .The micro sized uniform depressions that are formed on the surface increase the surface area of the tool without changing tolerances. Die failure is accelerated by continued expansion and contraction of the die's surface due to rapid changes in temperatures. The **MetalLife** increased surface area allows for more efficient heat sinking of the die which changes the thermal gradient temperatures thereby decreasing the Δ "T" operating parameters of the die. A lower Δ "T" is one of the factors necessary to reduce die fatigue.

INCREASED LUBRICITY. . .Maintaining lubrication helps to prevent oxides from forming on the die surface which could lead to galling. The uniform surface micro pockets, created by the texturing, retain and hold the lubricant on the die surface. Also the now non-linear surface increases the effective lubricating area which dictates greater lube retention. **MetalLife** is contrary to the long established belief that a highly polished and smooth surface is necessary for proper die operation. While a highly polished surface is more smooth, it also reduces the ability of the die to retain proper lubrication. Unlike an EDM or other type of textured finish, the **MetalLife** surface is non-stress oriented. This uniform non-stress oriented surface enhances the ability of the die to retain proper lubricant. As a result, there is a significant improvement in the final part smoothness and appearance.

A WORD ABOUT EDM SURFACES

Electrical Discharge Machining is a viable cost effective way to produce dies for the drawing/forming/blanking industry. Unfortunately, the melting and rapid solidification of the tool surface by this machining method reduces the dies mechanical fatigue strength by developing residual tensile stresses that lead to early failures and shortens normal tool life. Before processing, we recommend removal of this melted and solidified layer, also known as the white or recast layer. This layer, though very thin (15 to 50 microns), is extremely hard, brittle, and already contains cracks. Due to the extreme hardness, **MetalLife** is unable to induce the desired .010" to .015" of an inch sub-surface compressive stress boundary unless this layer is removed. Left alone, this recast layer's cracks will continue to propagate themselves to the untempered martensite and tempered layer immediately below. When this occurs, premature checking is rapidly evident, along with the sometimes unexpected premature catastrophic failure of the tool. If the die is stoned or polished to remove the recast layer, however, **MetalLife** can then be effectively applied to help maintain the original desired integrity of the tool.

Cross section micro photo of a tool steel surface with propagating crack in the recast layer.



OTHER APPLICATIONS

In addition to dies, **MetaLife** has also been found to provide significant benefits when applied to die pins and bushings. Galling of these parts is a very common occurrence. Again the process is applied to only the affected or working areas. Die pins are processed on the outside diameter. The bushings receive the process on the inside diameter.

PROCESS CHARACTERISTICS

Although **MetaLife** has proven itself both in the lab and hundreds of field tests, there remain some limiting characteristics which need to be explained.

1. The desired die hardness for application of the process is anywhere from 35Rc to an upward limit of 65Rc. This disallows its use on any variation of carbide tooling. Also, anything that compromises the upper surface hardness limitation will have a negative effect on the compressive stress depth of penetration along with limiting the ability to close small surface inclusions. Examples of this include improper heat treat, work hardening of the die, hard weld areas, or any previous surface treatment that hardens the skin surface such as nitriding or chrome plating.
2. While **MetaLife** will close minor surface inclusions, it is not designed to close structural or surface cracks. Also, previous conditions of breakout or pitting cannot be improved.
3. Extended maintained high treat conditions that are close to the annealing or tempering temperature of the steel, such as seen in hot forging operations, sometimes remove some or all of the compressive stress benefits. For this reason the process is not always recommended in extreme sustained high heat conditions.
4. **MetaLife** is not an abrasive process, therefore it is necessary that all galling and pickup be removed from the die and punches before sending it to us for processing.

PREPARING YOUR TOOL FOR PROCESSING

1. The die, if new, should be completely sample approved with all required engineering changes made to the tool. In addition, any required heat treat stress relieving should be done before sending the tool to us.
2. If the die is used and needs stress relieving, this should be done prior to our receiving the tool.
3. The die should be shipped to us in ready to use state with all finish polishing and sharpening completed. All galling and pick up, if present, should be removed.
4. The die should be disassembled to only its insert sections or component parts to prevent the media, which is extremely small, from infiltrating the die's interior. This also allows access to all areas that need processing.
5. All die pins should be removed if they are not to be processed. These holes will be plugged and protected prior to being processed.

FOR YOUR NEXT STAMPING PROBLEM DRAW UPON **MetaLife**.

Although not a panacea for all your manufacturing concerns, **MetaLife** is proving itself on a daily basis as a common sense approach to an ever present problem. **MetaLife** can make a significant contribution to your company's overall performance by improving your productivity, reducing your costs, and influencing how your customers view you and your operations. Please call or write us if you have any questions or require more information regarding **MetaLife** and the benefits you can expect. Our TOLL FREE number and FAX number are on the back of this brochure.

MetaLife®

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