

SUTTON+SCIENTIFICS, INC.

The Art and Science of Formulation

Acculap™ Premium Synthetic Polishing Pitches



*Setting a world standard for quality, consistency, and
advanced technology in precision polishing*

**High Purity
Precision Formulated
Non-Drying
Ultra Consistent**

Science Meets the Art of Precision Polishing

Polishing is one of the most delicate and sophisticated removal operations known. Should lap materials derive from ancient rosins

-or-

Can pitch lapping become a science based on advanced chemistry?

At Sutton Scientifics, we feel precision polishing should be based on science rather than alchemy. This simple idea led us to develop the world's first synthetic polishing pitches. Wizardry may exist forever, but we believe your finishing operations demand a scientific approach to pitch formulation.



Our synthetic pitches offer a proven alternative to tree sap and refining residuals. Acculap™ synthetic pitches are precision formulated to provide ultra stable and consistent properties. In addition, Acculap™ is produced using modern quality control and the most advanced understanding of pitch rheology in the world.

Chemistry and Science applied to Polishing Pitch

Consistency and quality begin with selection of raw materials.

Acculap™ synthetic pitches are formulated using patented technology to achieve extreme purity, consistency, and stability. All raw constituents are selected for pure composition, low volatile content, and resistance to chemical degradation. As a result, Acculap™ pitches are extremely pure, contaminant free, and do not dry, harden, or change in any way over time (even at elevated temperatures).

Consistency and quality are further insured by precision manufacturing.

The raw components of Acculap™ are precision batched to yield precisely the same physical properties time after time. Manufacturing tolerances and processes are highly optimized to insure rigorous product consistency. Essentially, we apply modern engineering to the production of polishing pitches and systematize, for the first time, pitch quality control.

The most advanced tools for pitch characterization in the world.

Sutton Scientifics, Inc. has developed the most comprehensive understanding of pitch rheology in existence. This foundation, coupled with state-of-the-art instrumentation, enables unprecedented precision in the measurement of hardness (and other properties). As a result, we can offer sophisticated characterization tools as a basis for applications engineering and control of product quality.

We guarantee the most reliable and premium quality pitch available.

We stand behind every gram of Acculap™ sold anywhere in the world and are prepared to guarantee its performance. In addition, we provide high level technical support including access to sophisticated characterization technology. Whatever your need for polishing pitch, we offer a premium alternative with unsurpassed product sales and technical support.

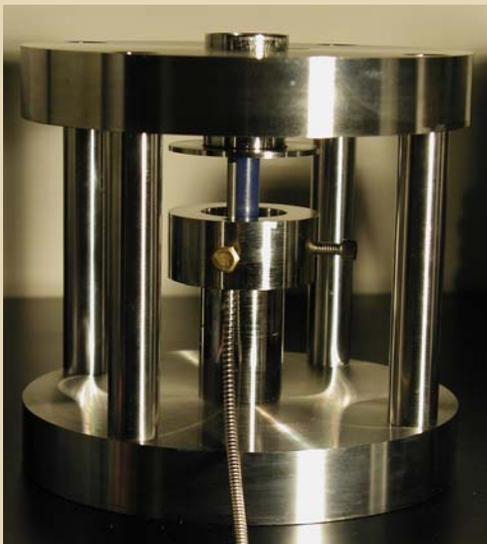
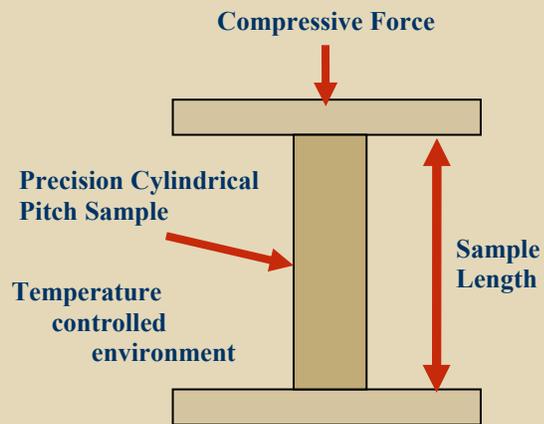
Pitch Rheology - A Performance Prerequisite

rheology\re'-a-le-je\n: a science dealing with the deformation and flow of matter also: the ability to flow or be deformed. **Merriam-Webster's**

“Pitch flow affects lapping in at least two ways 1) allowing polishing agent particles of polishing agent to seat into the pitch surface and 2) enabling the lap to mate with the surface being polished.”

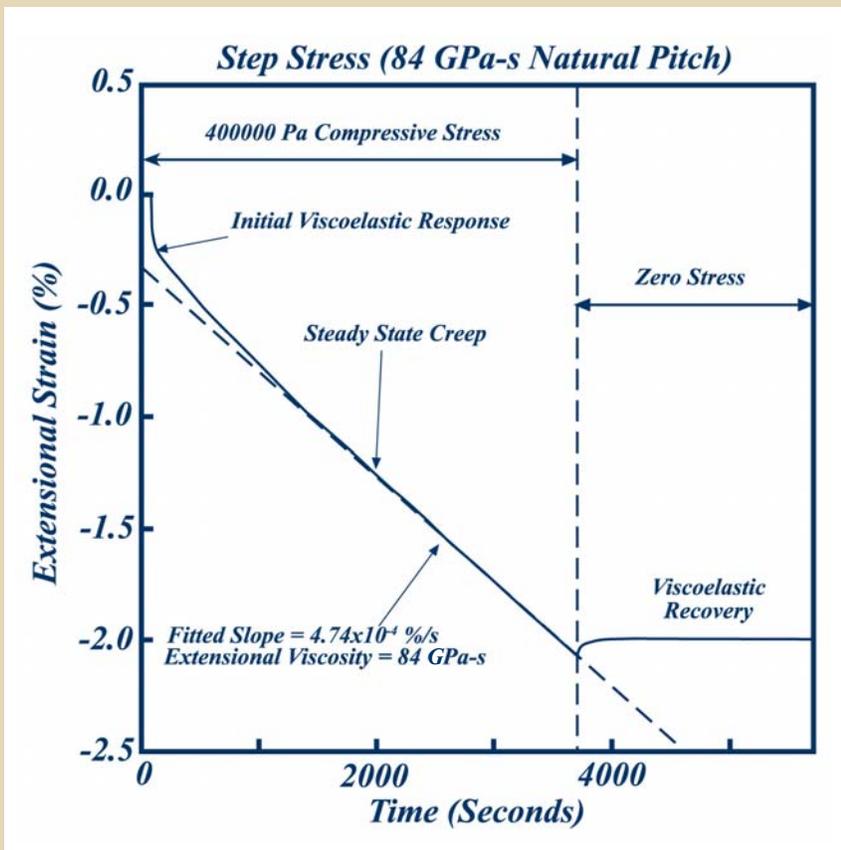
Norman J. Brown - Lawrence Livermore

As anyone involved in pitch polishing knows, “hardness” plays a crucial role in lap performance. But - what is “hardness” and can it be accurately understood in relationship to lap performance? To answer this question we employ a rheological technique originally developed for the study of polymers. In this method, a precise cylinder of pitch is placed between flat platens and compressed under a known axial stress.



While accurately controlling temperature, platen separation is measured using a laser device. Over time (ranging from hours to days) longitudinal sample deformation is observed in response to applied stress. Several experiments, with different loads, may be utilized to comprehensively map strain rate in response to stress. In this way, pitch rheology (deformation due to stress) may be understood and used to quantify “hardness” and related polishing characteristics.

Quality based on the most advanced pitch characterizations in the world



In a typical rheological experiment, deformation of a sample (shown here as a percentage change in length) is measured following the application of stress. The incredible accuracy of our technique allows observation of initial viscoelastic effects and subsequent steady state creep or flow. Even slight viscoelastic recovery of the pitch, following removal of stress, may be measured in detail.

Such data may be used to carry out any number of important analyses including calculation of creep viscosity.

Extensional creep viscosity (simply the applied stress divided by the steady state strain rate) is the most accurate measure of pitch flow (or “hardness”) known. This viscosity is most often converted to traditional shear viscosity by the relationship:

$$\text{Shear Viscosity} = (1/3)(\text{Extensional Viscosity}) - 16 \text{ GPa-s in the example above.}$$

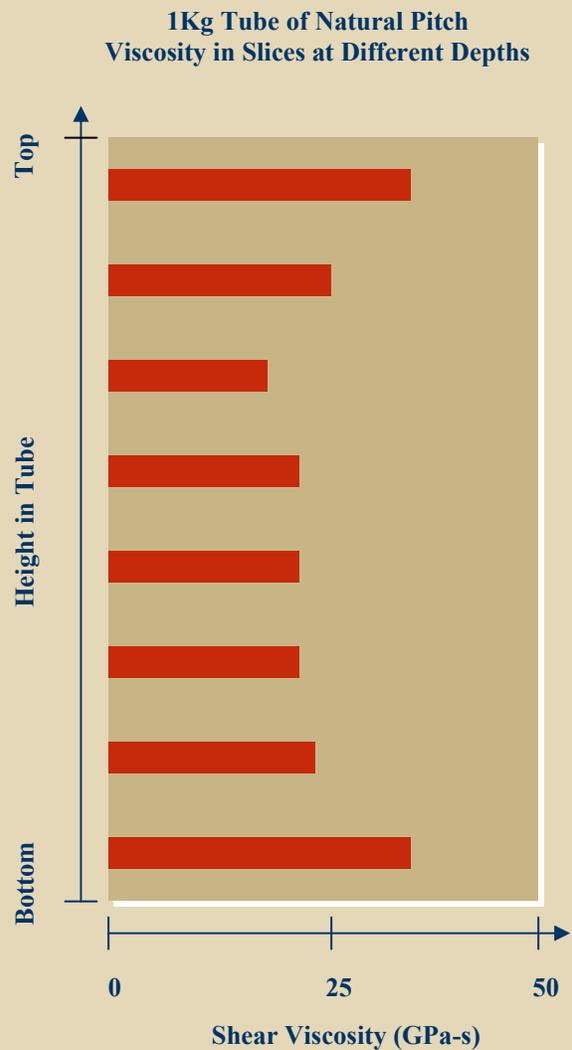
This value provides a direct measure of lap flow characteristics or pitch “hardness”.

Hardness Comparisons and Selection of Acculap Grade

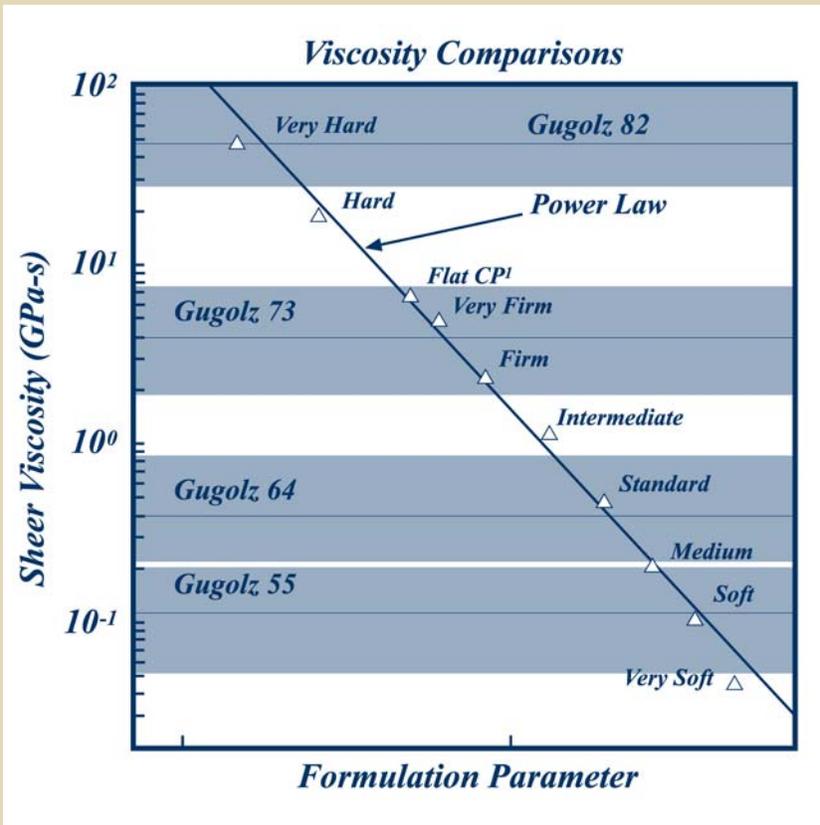
How do Acculap™ grades compare in “hardness” to Gugolz and other polishing pitches?

We can provide Acculap™ comparisons and match the hardness of any pitch (although competitive pitches are variable and difficult to pin down).

For selecting grades, comparisons with Gugolz and other pitches are useful. However, traditional pitches are so variable (even within batch), that assignment of hardness is problematic. This issue is well illustrated by the data at right showing viscosity in slices through a 1Kg cylinder of natural pitch (as delivered by the supplier). Given such variance, averages can be quite misleading. Rather, it is best to associate a given natural pitch with a likely range of viscosity. Of course, even this range may drift over time (with changes in raw tree rosins, etc.).



We Characterize Pitch So You Don't Have To



For comparisons, we have extensively measured the viscosity of various natural polishing pitches. Although competitive pitches cover broad ranges, average viscosity, and likely ranges for important Gugolz pitches, are shown here as blue bands (with center lines for the average).

Beyond characterization of natural pitches, we have mapped the viscosity of Acculap™ pitches as a function of proprietary formulation. The figure shows such a mapping across standardized Acculap™ grades.

Given this type of data, it is possible to provide anticipated hardness comparisons between various natural pitches and specific Acculap™ grades. In addition, with mappings of viscosity across Acculap™ composition, we are able to “dial” any desired Acculap™ hardness. In fact, we can easily characterize and immediately match any lot or blend of pitch currently in use.

Standardized Acculap™ Grades

To avoid mixing different grades (as with competitive pitches), we standardized an Acculap™ series with fine levels of hardness appropriate for nearly any application.

Standardized Acculap™ Grades

Formulation Name	Shear Viscosity (GPa-s)	Hardness ¹	Equivalency
Very Soft	0.050	0	
Soft	0.100	9	Gugolz 55
Medium	0.203	18	
Standard	0.467	30	Gugolz 64
Intermediate	1.130	39	
Firm	2.330	48	
Very Firm	4.670	60	Gugolz 73
Flat CPI	6.670	63	
Hard	18.30	78	
Very hard	46.70	89	Gugolz 82

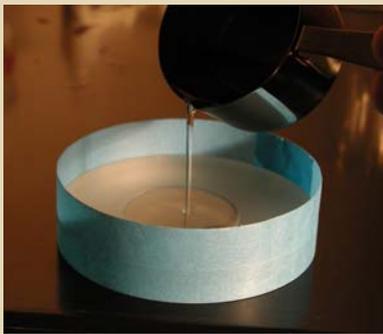
Standardized grades are sold either black or with water white clarity. Clarity enables internal inspection of laps (for pouring defects, etc.), while pigmentation is desirable for evaluation of charging and conformance.

These grades meet the needs of most users (without mixing), but any level of hardness is available on request.

¹*It is convenient to define a hardness scale as $30\log(\text{shear viscosity}/0.05 \text{ Gpa-s})$ such that 0 approximately represents the softest pitches employed for polishing and 100 is at or above the maximum useful hardness.*

General Answers to Frequently Asked Questions

How much Acculap™ do I need and how is it packaged? *Acculap™ pitches have a density of approximately 1.05 g/cc (very close to that of natural pitches). Thus, the mass required for a given lap is approximately equivalent to that in natural pitch. Standard packaging for Acculap™ includes 1/3 Kg aluminum tins and 55 gallon drums (180 Kg net).*



How is Acculap™ heated and poured? *Acculap™ pitches are all designed to be easily poured at a temperature of 135°C (similar to natural pitches). Odor is minimal while the material is non-toxic and highly stable against drying. Consequently, Acculap™ processes without the odor, health concerns, and drying sensitivity of natural pitches.*

Does Acculap™ polish well? *Acculap™ pitches are designed to perform just as natural pitch of comparable hardness. Minor differences in wetting, initial charging, and channeling may be noticed but performance is superb. Acculap™ is used in lapping all types of materials and with typical slurries. Current applications produce finishes down to the level of Super polishing.*



General Applications Information

Whatever the polishing application, a properly selected Acculap™ grade should work like a natural pitch, and behave consistently (time after time).

Pouring, adherence, and channeling.

In general, Acculap™ pitches are poured near 135°C (similar to natural pitch). At this temperature, Acculap™ spreads and pours easily. Acculap™ bonds well to most materials, particularly surfaces warm prior to application. Aggressive bonding is facilitated by pretreatment of surfaces with a coat of Acculap™ dissolved in acetone. Once poured, Acculap™ is somewhat more brittle than natural pitches, leading to some differences in channeling. Typically, however, only minor refinement of technique is needed to achieve excellent results. Sharp blades and fast cutting speeds work best.

Chemical characteristics, stability, and solubility.

Acculap™ pitches dominantly comprise styrenic polymers and consequently, are highly stable against chemical attack, including high temperature oxidation or degradation. Aromatics, ketones (including acetone), and warm oils are quick acting solvents. Lower oils, including odorless mineral spirits, are slower acting solvents. Acculap™ is impervious to polar liquids such as alcohols (which may be used as a basis for slurries with Acculap™).

Wetting and charging.

Acculap™ pitches are not immediately water wetting (without surfactants). As polishing begins, however, wetting of the lap occurs quickly as slurry particles embed in the pitch surface. In most processes, charging and wetting of the lap are almost immediate. Warm or cold pressing with slurry will accelerate charging. Pressing is facilitated by the lesser tendency of Acculap™ to bond with the work piece (as is often encountered with natural pitch).

Polishing characteristics.

Once charged, under given lapping conditions, Acculap™ will polish much like natural pitch of comparable hardness. Just as with natural pitches, periodic dressing and trimming of the lap, as well as replacement of slurry, will be required. Achievable finishes often extend into super polishing. Typically, we can offer new users processing examples (in CP and other scenarios) as a guide for turnkey implementation. We can also provide access to a network of users able to provide general applications assistance (some users can share specific information within proprietary limits).

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Please let us help you implement Acculap™

Sutton Scientifics, Inc. is committed, in partnership with our distributors, to provide the highest level of product support in the industry. Whether your need for polishing pitch is large or small, standard or exotic, off the shelf or custom, we want to help. We stand behind every gram of Acculap™ sold anywhere in the world and I am personally available, at any time, to resolve any issue related to product quality.

Please, let us hear from you,

*Dr. Stephen P. Sutton
President, Sutton Scientifics, Inc.*

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Take the Next Step

Try Acculap™ Premium Synthetic Polishing Pitches

**21st Century
High Purity
Precision Formulated
Non-Drying
Ultra Consistent**

Why wait any longer? Contact us today
and let us help implement a modern
alternative in your pitch lapping process.

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