



Sound Synergies Barrier Films Reduce Surface Tension in Metals

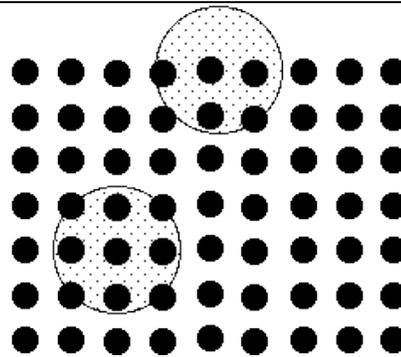
Barrier films and barrier film technologies are relative newcomers to the music instrument maintenance industry. Multi-Marketing Corporation, our parent company, first introduced barrier film technology to the ballistics and tool and machine industries over 30 years ago. Our Sound Synergies formulas are based on some of our top selling products in those industries.

The physics and characteristics of metals are the primary factors taken into account when developing our formulas. For instance, the development of CymbalCare for cymbals and plates was based on research into the effects of barrier films on metal surface tension, temperature and moisture; kinetic energy, impact resistance, chaotic vibration, and random motion. Forces like kinetic energy, the process of stick striking the cymbal surface thus a transfer of energy occurs which is based on factors like speed, force, and material density. Our claims are also based on much of the quantitative and qualitative data gathered from other industries that subject our formulas to high-stress environments such as high static loads, explosive impact, and moisture and temperature extremes. This data has substantiated our claims that our formulas have an extremely low migration, are stable and self-leveling under pressure, moisture and temperature extremes. Claims based on actual testing are:

- Creates a dry-film boundary that carries a 3,000 lb. load carrying capacity (six times US military spec)
- Will protect all metals from warping or overheating up to 450 degrees
- Water & humidity will not diminish the effectiveness of our HD4X™ film
- Prevents rust and corrosion from forming on metals (400 to 600 hour salt spray test)

Surface tension in metals is very important when considering the performance and life of a cymbal. Let's take Cast Iron for instance. The surface energy is very large for Cast Iron, which is a brittle material that shatters without much warning. Since brittle fracture creates new surfaces, the *surface energy varies inversely with the tendency to brittle failure*. This means the lower the temperature of a metal surface the corresponding surface tension increases along with brittleness. In addition, any substance that can help reduce surface tension and surface impact will lessen the likelihood of micro-fissures forming and leading to eventual cracking of metal surfaces. We can say without reservation that the application of CymbalCare to all cymbal surfaces is a low-cost preventative measure.

Surface Energy and Temperature or why reducing surface energy at all temperature ranges is an added bonus. In the bulk, atoms are evenly surrounded and the cohesive forces between the atoms tend to balance. On the surface there are atoms on one side only, so there is a net inward cohesive force. This creates a force on the surface that tries to minimize its area. When considered as a force rather than energy, the force is called "surface tension".

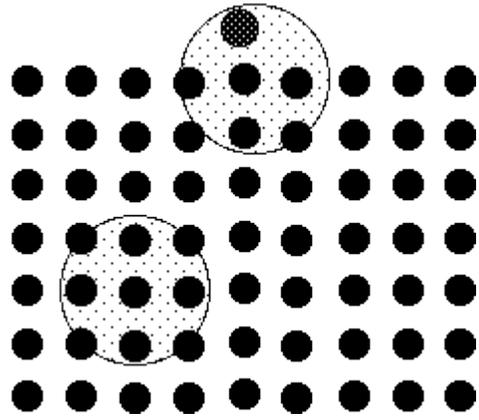


As temperature increases, the atoms in a solid vibrate more, and reduce the cohesive force binding the atoms. The surface energy depends on the net inward cohesive force and so surface energy decreases with increasing temperature. The surface energy for many metals (e.g. Ag, Au, and Cu) goes down by about $0.5 \text{ mJ.m}^{-2}.\text{K}^{-1}$ with increasing temperature. Water goes down by about $160 \text{ mJ.m}^{-2}.\text{K}^{-1}$.

Surface Energy and Contamination and "why black oxides and other build up on your cymbals makes them eventually sound bad."

Contaminant molecules *adhere* to the surface ("*like*" *cohere* and "*unlike*" *adhere*).

The contaminant molecules thus change the balance of forces and reduce the net inward force. Since the net inward force is related to the surface energy, the surface energy is reduced by contaminants. **But surface energy reduced by contaminants that will eventually oxidize, pit, or corrode the metal surface is undesirable. This is where Sound Synergies micro-barrier film formulas go into action to "fill-in" micro fissures and pits. Sound Synergies will clean, condition and protect metal surfaces while reducing surface tension.**



This may also explain why patinas (natural surface aging) give certain cymbals a 'warm' or 'smoky' sound by reducing surface tension and brittleness.

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