Ask The Oracle

Question - to be answered in the next issue

Answers to Last issue's Questions:

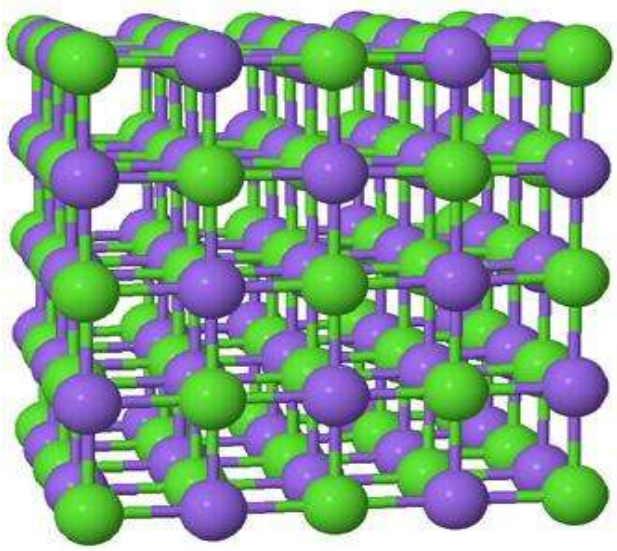
What causes directional properties in some materials? **-Answer by Tim Smith**

The reason why faceting materials show directional hardness relates to the atomic or ionic lattice structure of the material.

Ignoring a few non-crystalline materials such as glasses or gels (opal), all faceting materials are crystalline. As such the atoms that they are composed of are linked together in regular arrays or lattices. Traditionally, in the chemistry class, these lattices have been displayed as "ball and stick" models where the ball is the atom and the stick is the bond between atoms.

Many structures are anisotropic – not the same in all directions – and often have a layered structure. In many minerals the chemical bonds (the sticks) are weaker between layers than within them. This results in a structure that breaks preferentially in certain directions. This regular internal weakness is known as cleavage. Mica is a mineral famous for its highly developed cleavage. The cleavage in mica is so extreme that it effectively prevents this material from being faceted but the property is well known in many faceting materials and can make them extremely challenging to cut and polish. Try to cut kyanite, barite, kunzite or apophyllite and you will be well aware of cleavage.

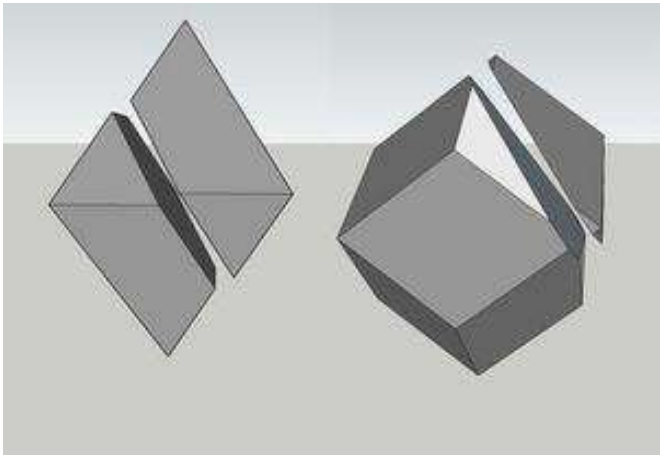
However, many faceting materials do not have cleavage but still have a marked directional hardness. For these materials the regular lattice is there but the bond strengths (the sticks) are more or less uniform in strength. The material shows no cleavage. Even so, the bonds are arranged in regular directions. When the motion of the lap is across the bonds the faceting material is more brittle and more easily abraded than when the lap direction parallels the bonds.



So directional hardness is due to the underlying structure of the faceting material, related to but not necessarily the same as cleavage. Indeed our hardest faceting material, diamond, has a curious relationship between hardness and cleavage. Diamond normally occurs as octahedral crystals. The cleavage direction parallels the octahedron faces.

However, it is impossible to cut diamond along a cleavage plane. The softest direction and easiest to cut is to cut across the point.

This is why diamond cutters have unique “quoin” and “skill” facets where a humble coloured stone cutter would just have “breaks”. Diamond facets have to be cut so as to exploit the directional hardness of the stone. In contrast we coloured stone cutters generally only notice directional hardness when we over cut a soft facet.



Incidentally, depending on the structure of the stone being faceted, a soft facet may be repeated regularly around the stone. If you are using a 96 index wheel and a facet on index “15” cuts too deeply, don’t be surprised if the same happens on index “63”.

To return to the beginning of this answer, what about glass? Glass has no structure and so no preferential bond direction. Glass does not have directional hardness.

I have 4 different varieties of dopping wax. These are: Black, Green, Brown and Red. What are the functions and capabilities of each? I have read before that black is the best for faceting, but have seen no descriptions of the other 3 (maybe there are more as well?). I have not tried any of the others for faceting, but I have ventured forth with both the green and red waxes for cabachons, with acceptable results. Naturally cabachons do not encounter the same pressures and heat build up as a faceted stone does, but would they suffice for this, and is there any special procedure to follow for each kind?

Answer by Mike Richardson

GREEN WAX Intended for dopping cabochons, low temperature,melts at 160F suitable for heat sensitive stones, eg turquoise and opal.

BLACK WAX Use when high holding strength is required, stones have less tendancy to move on the dop with this wax, useful when grinding and polishing require extra pressure, melts at 170F.

BROWN WAX A cheap reliable wax suitable for general faceting. When I used hot wax dopping this is all I bothered with. Providing it is applied correctly it produces a good bond. Some faceters advocate first painting the stone with shellac,(dopping wax disolved in surgical spirit), I never found it neccessary, but if you do this, make sure that the shellac coat is dry and hard before dopping.

STICK SHELLAC A high temperature shellac used when dopping stones which require extra holding power melts at 176F, make sure the stone is heated carefully.

RED WAX As for Brown, make sure it is not sealing wax, which will work but can be brittle, especially if it is heated a few times or gets too hot. Contrary to what the questioner said, faceted stones require MUCH LESS pressure and heat than cabochons.. Ref. Graves catalouge no 241

Do you have any questions that you would like answered?

If you do then send them in to the editor.