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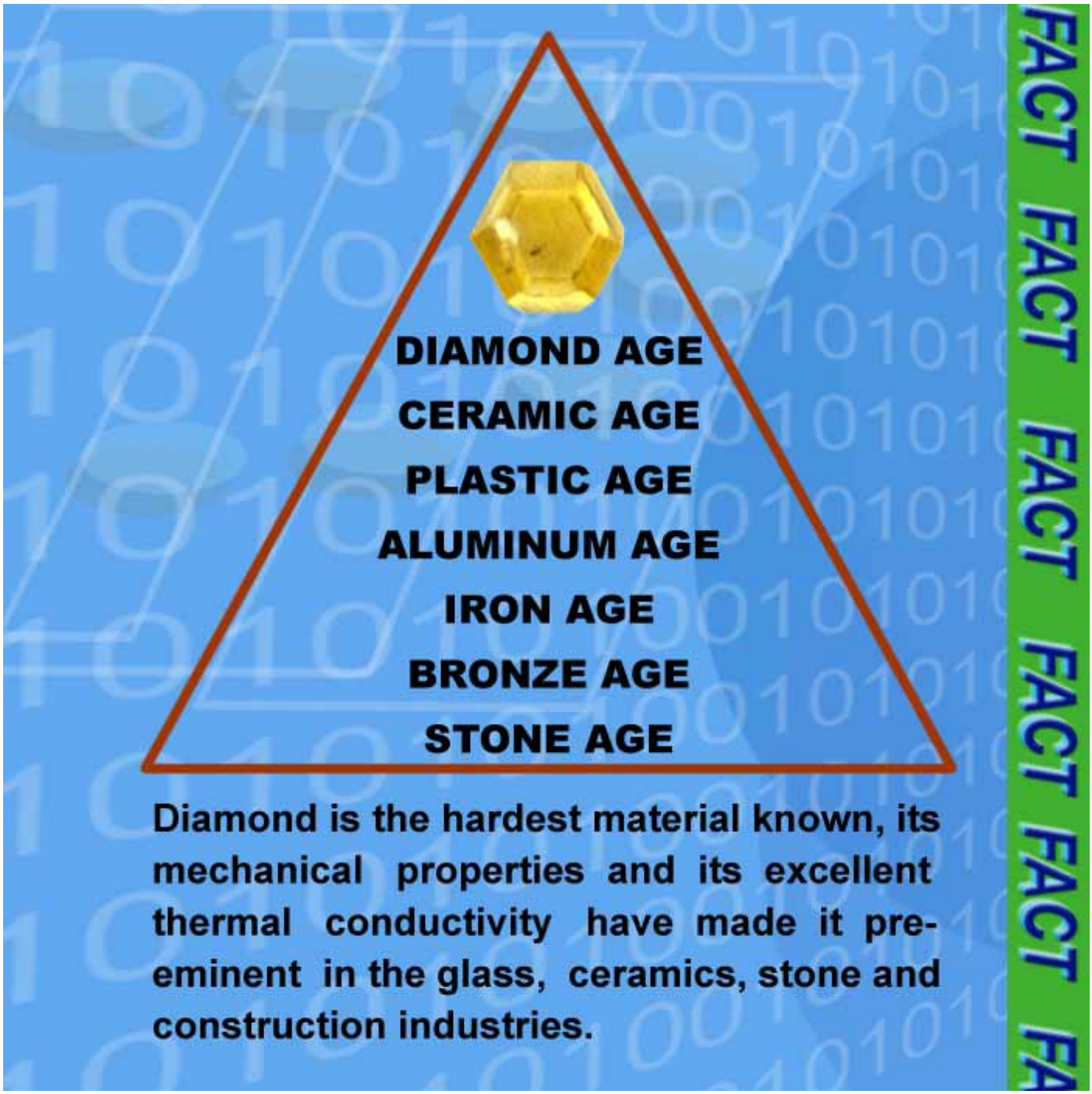
DIAMOND AGE



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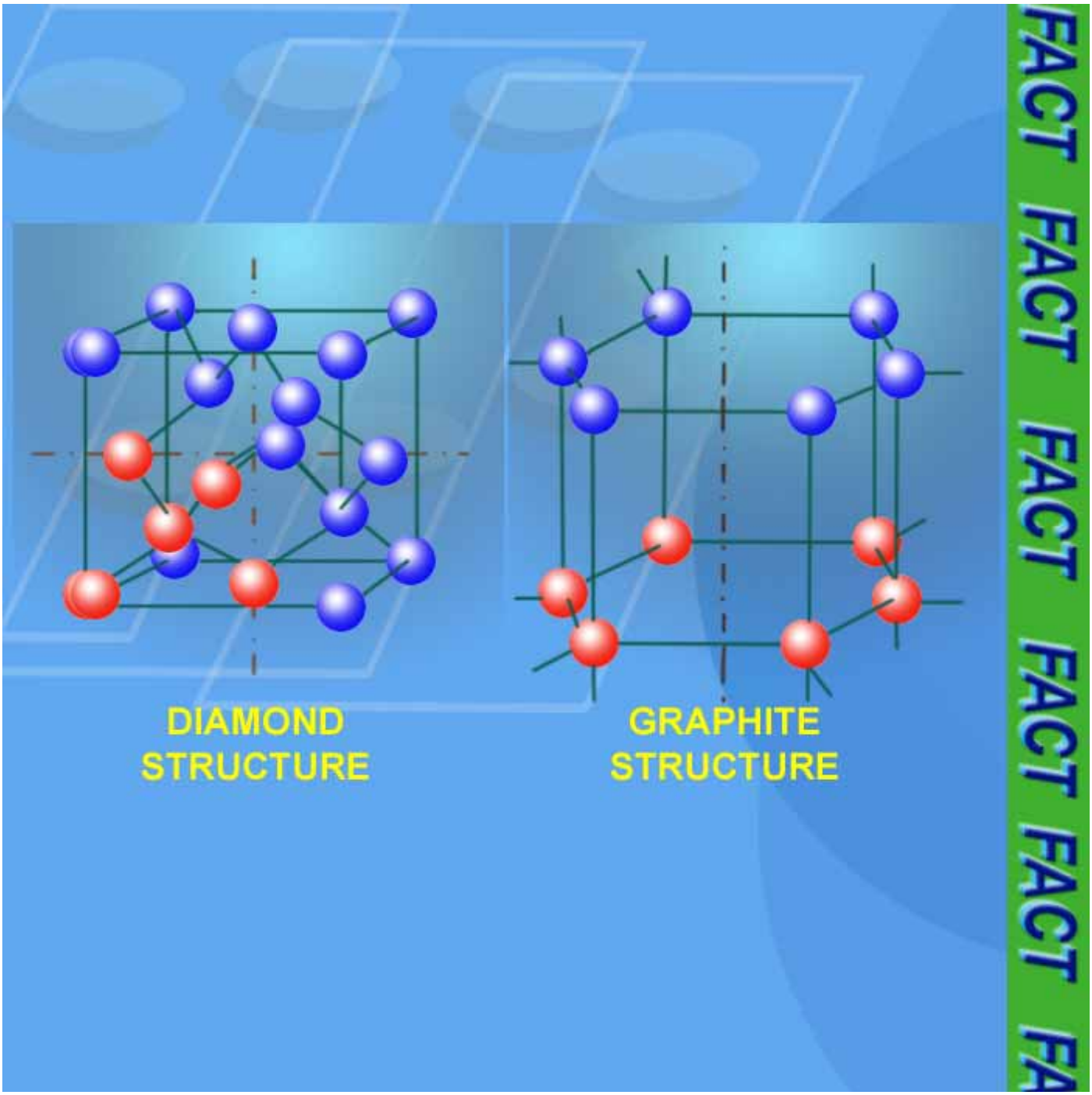
DIAMOND AND GRAPHITE STRUCTURES



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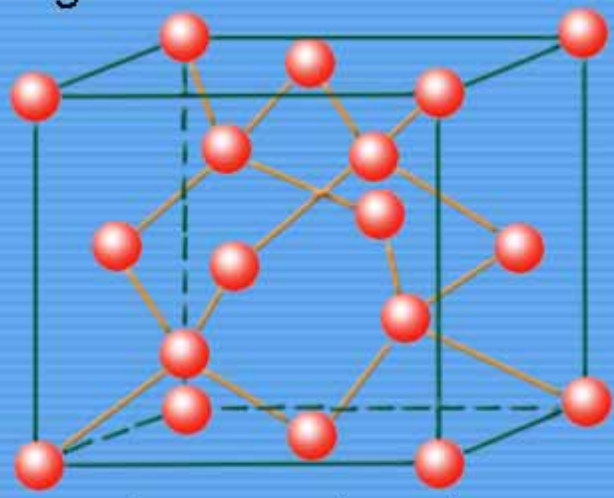
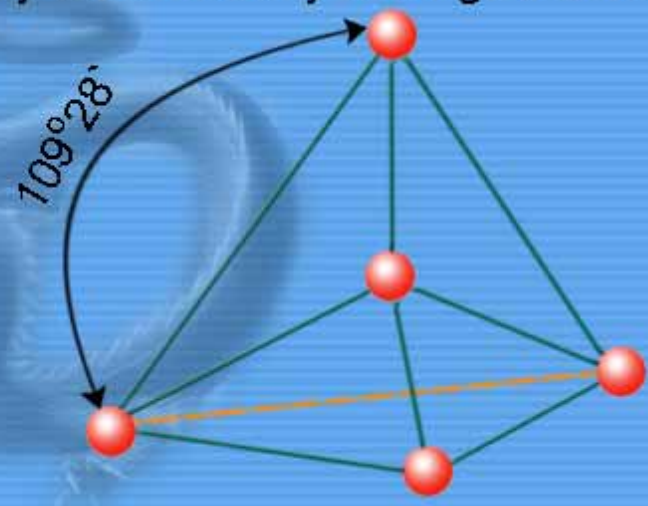
THE BONDING IN STRUCTURE OF DIAMOND

The structure of diamond the following, each carbon atom is bonded to four other carbon atoms with pure covalent bonding.



The chart bottom shows each carbon atom in the structures is bonded to four other carbon atoms with perfectly tetrahedrally arranged bonds.



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PRINCIPAL PROPERTIES OF DIAMOND

Property	Value
Hardness	10,000 kg/mm^2
Coefficient of friction	0.03
Sound velocity	18,000 m/s
Density	3.52 g/cm^3
Thermal Expansion coefficient	1.1×10^{-6} K^{-1}
Thermal conductivity	20.0 W/cm-K
Optical index of refraction	2.14
Resistivity	10^{13}-10^{16} Ω-cm
Atoms densities	1.54 Å
Melting point	4,000 K

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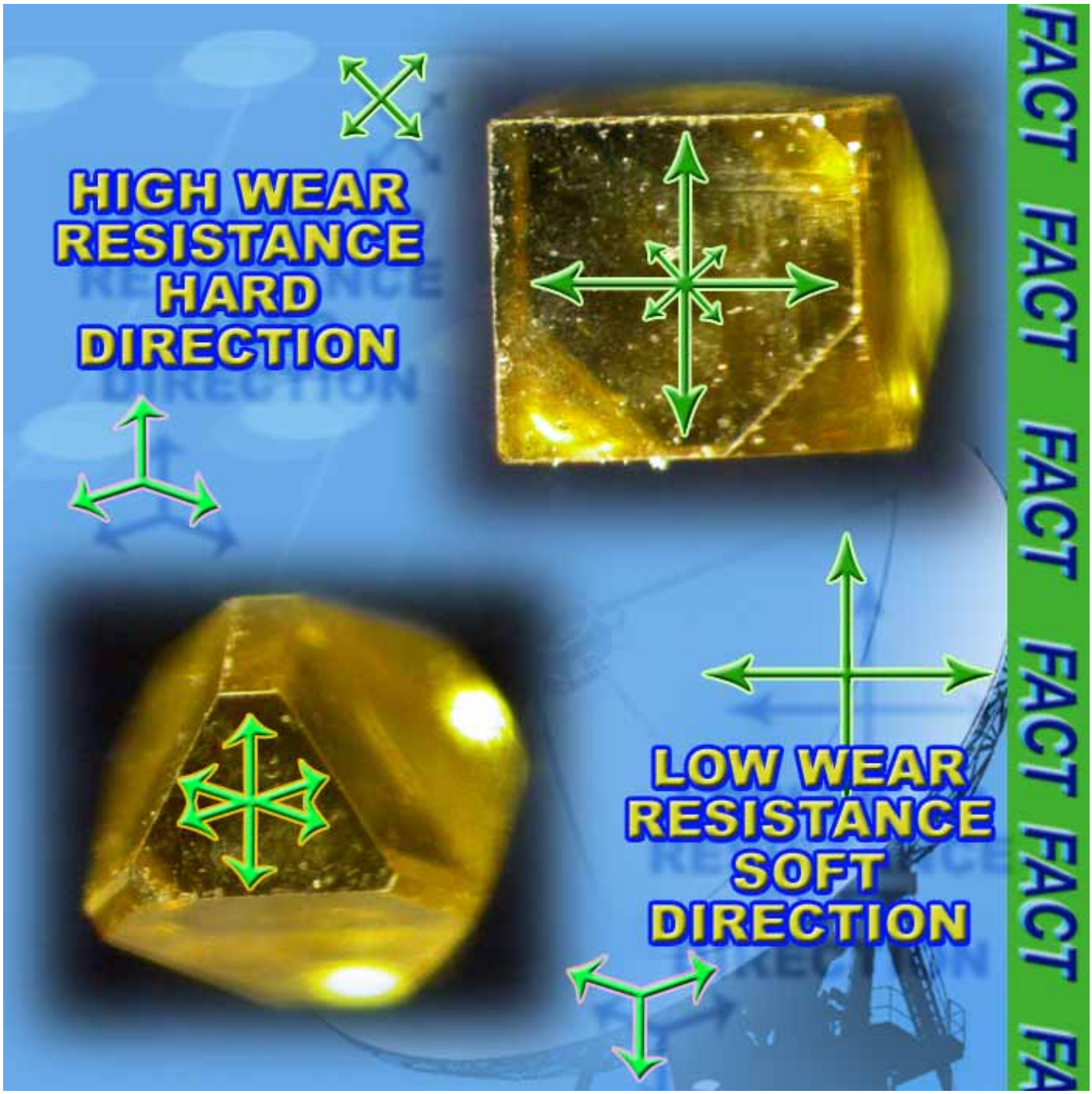
WEAR RESISTANCE DIRECTION



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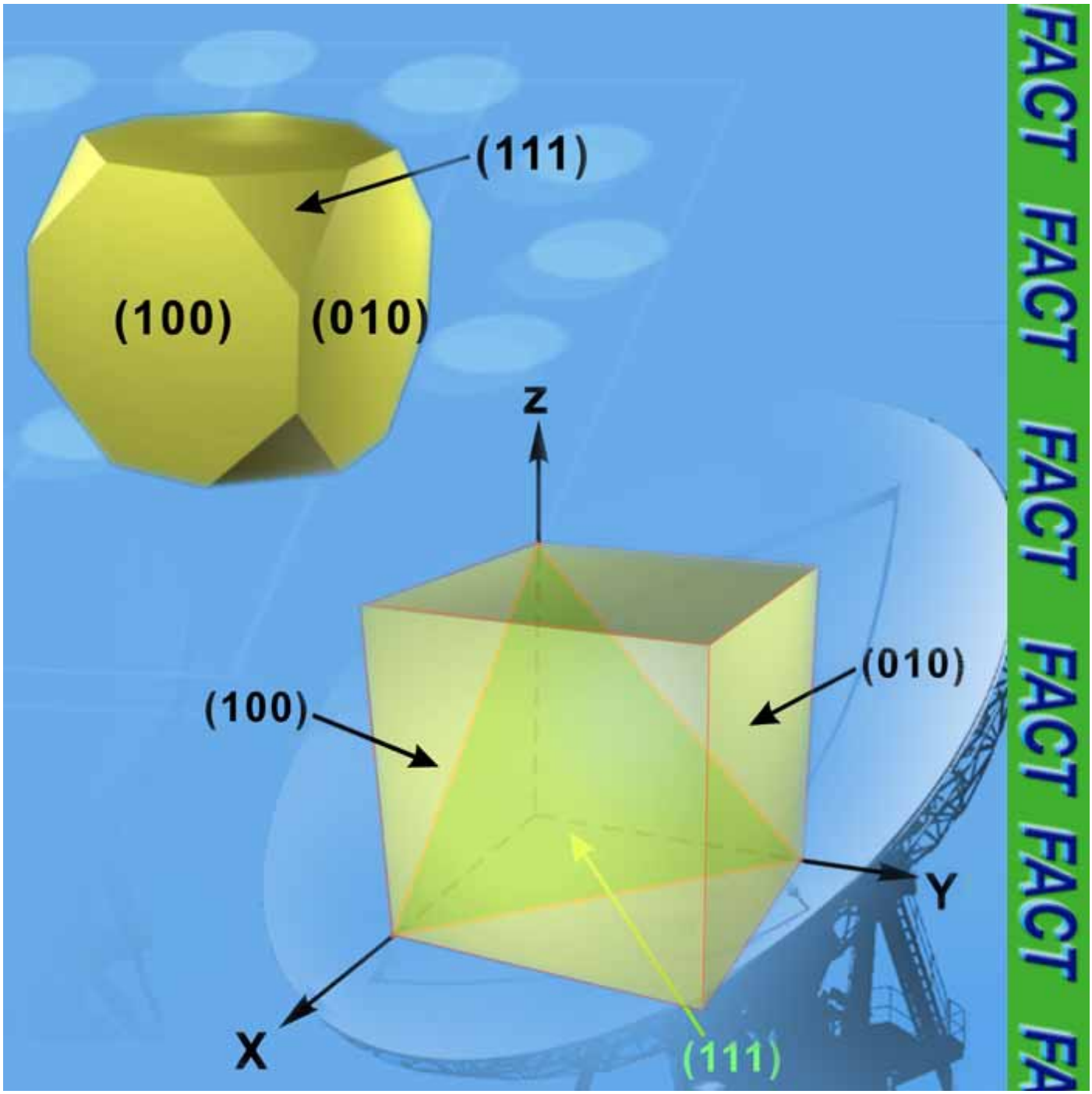
MILLER INDEX



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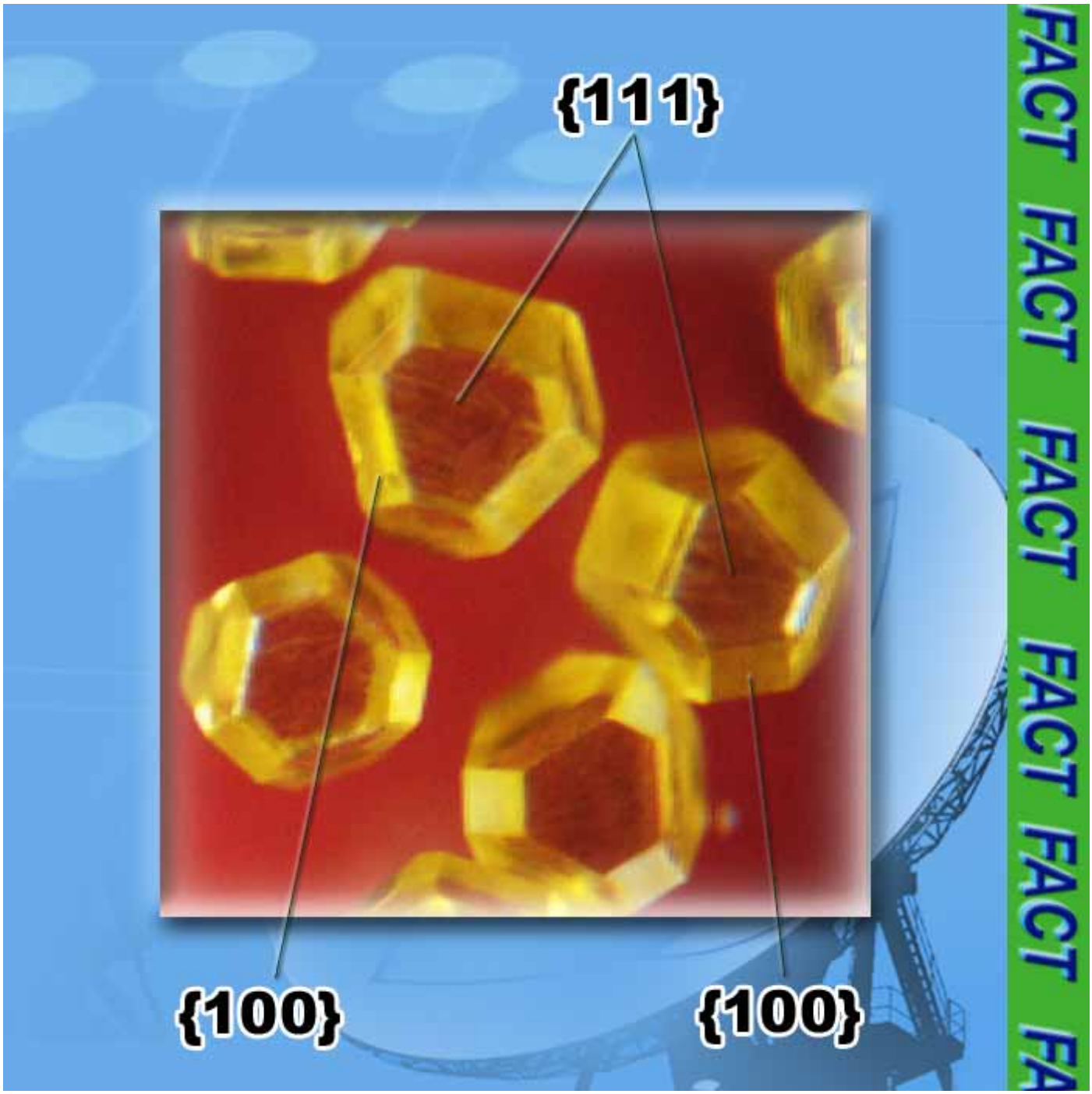
DIAMOND CRYSTAL FACES



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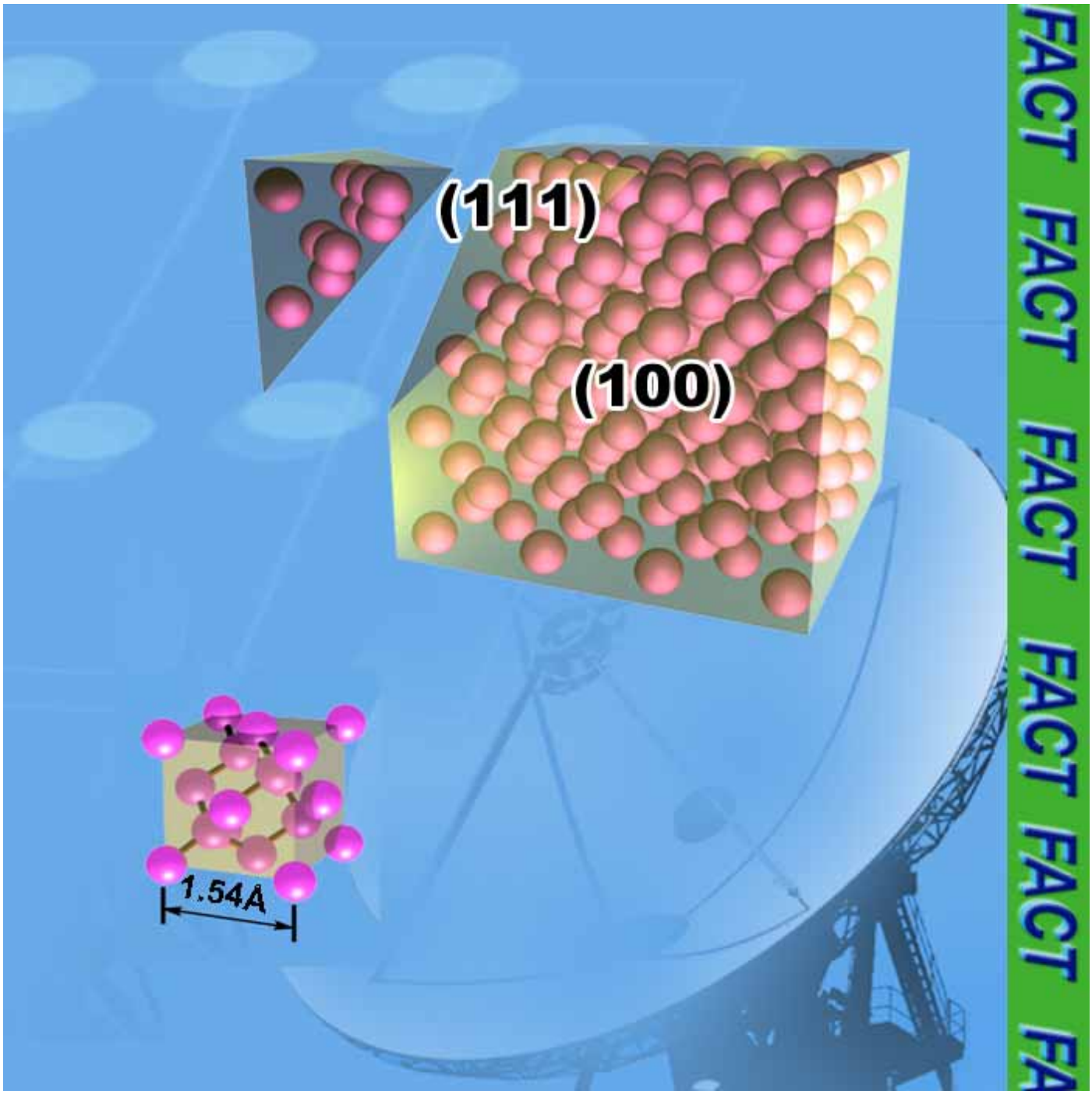
CLEAVAGE OF PLANE



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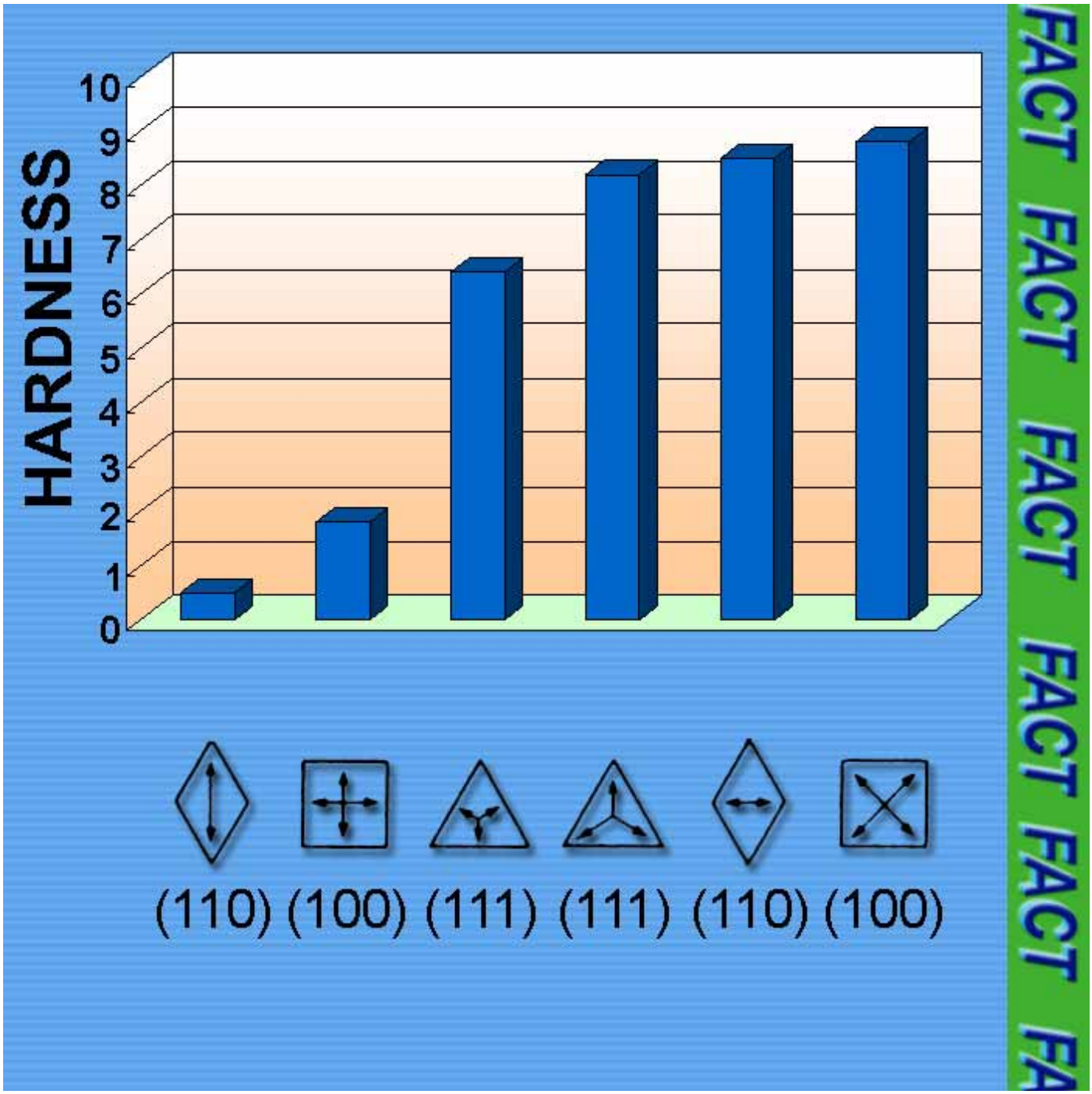
HARDNESS OF CRYSTAL PLANES



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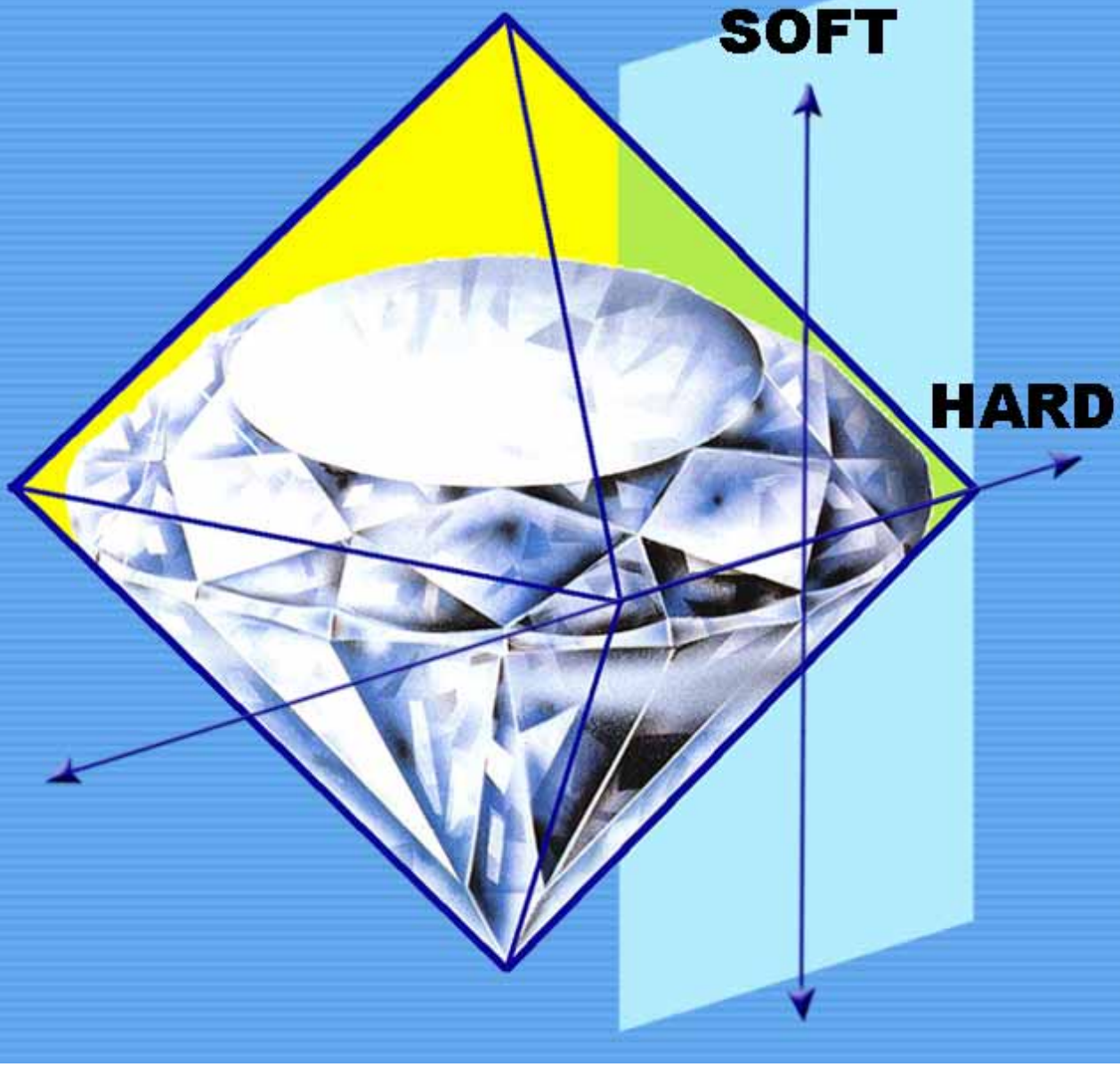
THE DIRECTION OF DIAMOND CRYSTAL PLANES

Single crystal diamond has " Hard " and " Soft " directions related to the crystal orientation.



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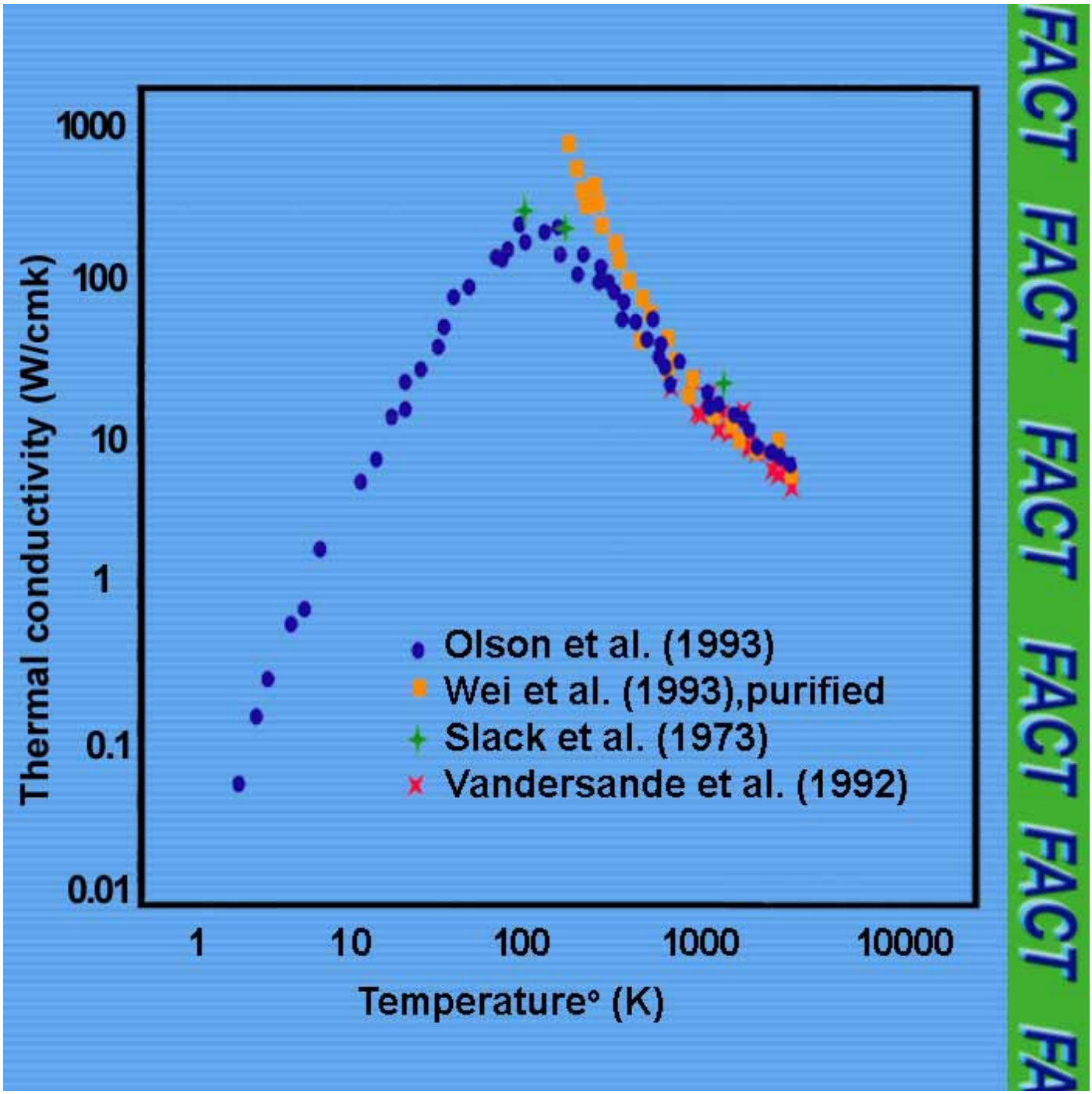
THERMAL CONDUCTIVITY



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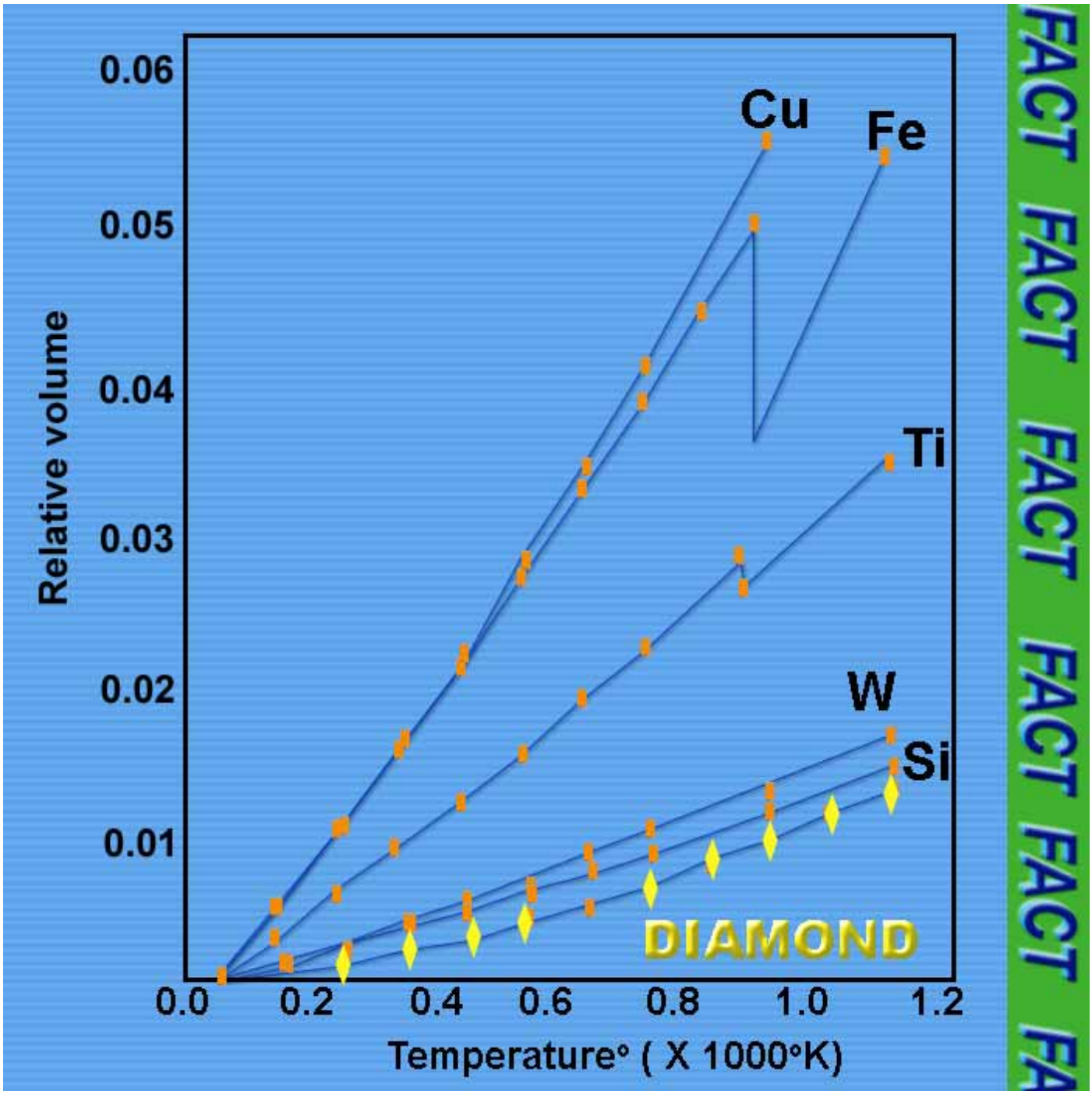
THERMAL EXPANSION COEFFICIENT



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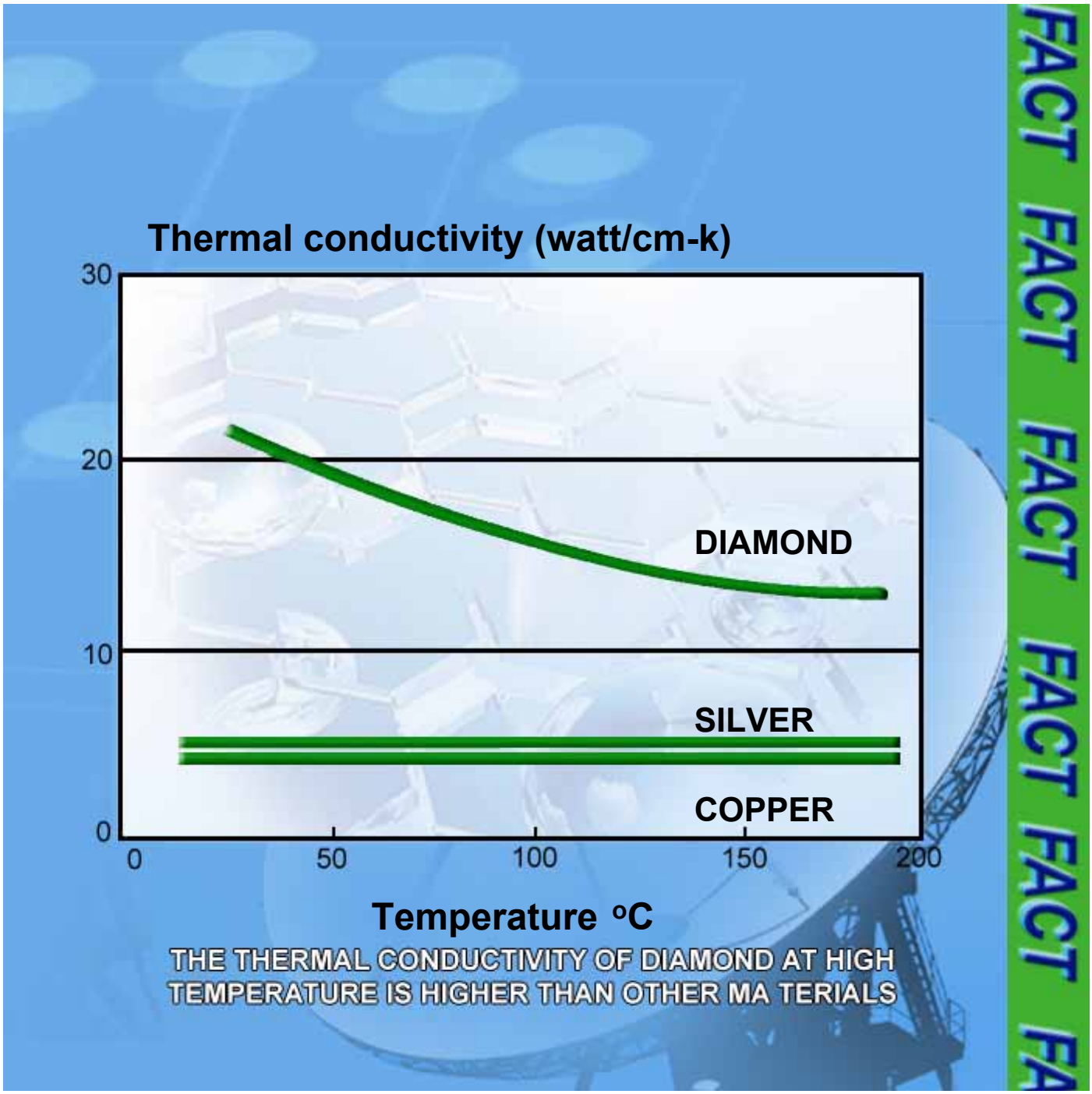
THE THERMAL CONDUCTIVITY OF DIAMOND COMPARING WITH OTHER MATERIALS



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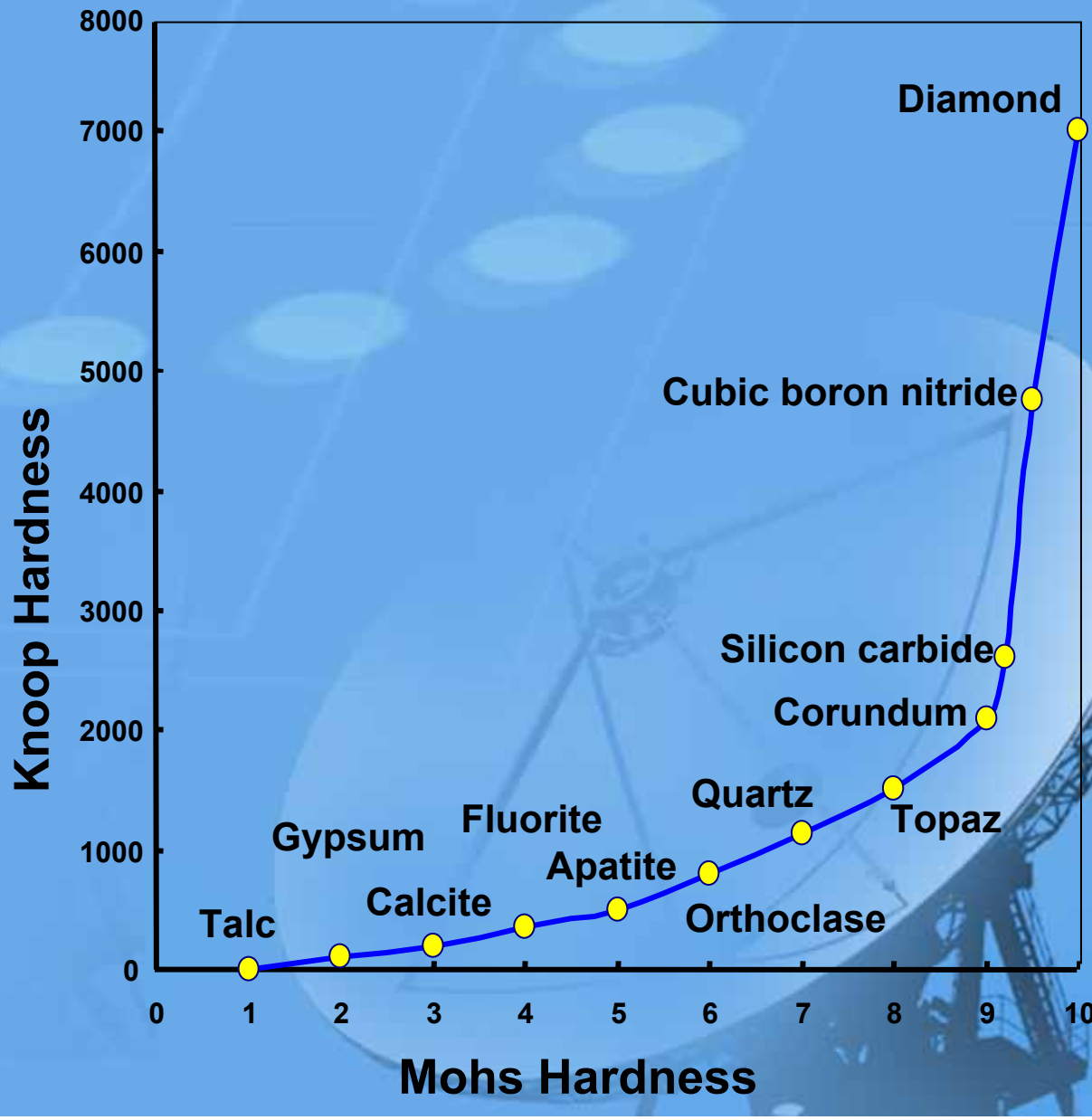
DIAMOND HARDNESS

THE CHART SHOWS DIAMOND HARDNESS RELATED TO THE HARDNESS OF OTHER SUBSTANCES



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COEFFICIENT OF FRICTION OF MATERIALS

COEFFICIENT OF FRICTION OF MATERIALS

MATERIAL	COEFFICIENT
DIAMOND	0.05
TEFLON	0.05
GRAPHITE	0.10
SAPPHIRE	0.20
TUNGSTEN CARBIDE	0.20
Ni	0.70
Cu	0.90
Fe	1.00
Al	1.30
Ag	1.40
Pb	1.50

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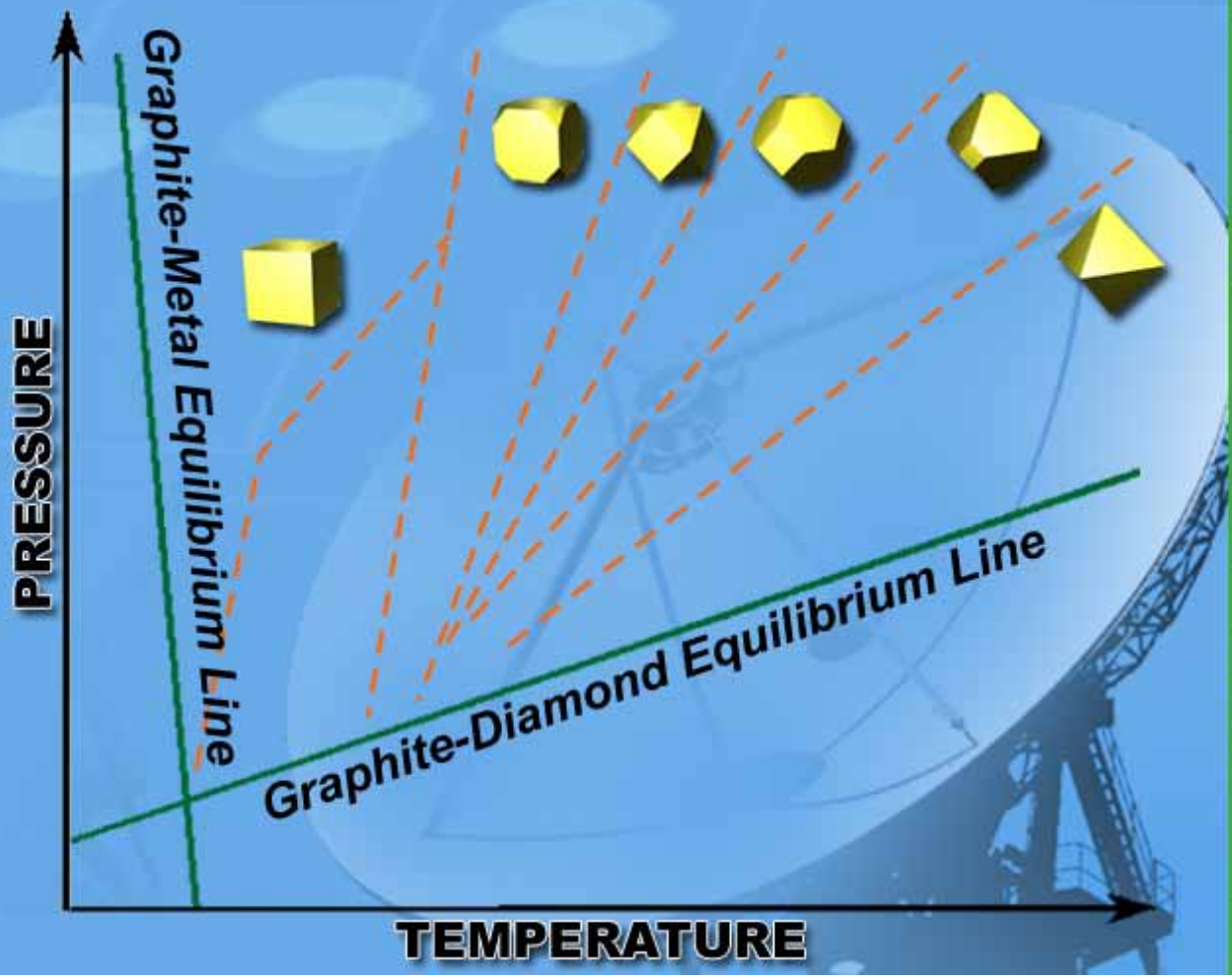
THE SYNTHESIS PROCESS OF SYNTHETIC DIAMOND

The characteristic crystal shape grown under the lower possible temperature and pressure is the cube, at higher synthesis temperatures, the characteristic octahedral faces become increasingly more prominent, an intermediate shape of synthetic diamond is the cube-octahedron.



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THERMAL PROPERTIES OF DIAMOND VS. OTHER MATERIALS

Properties / Material	Conductivity W/mK	Specific Heat cal/g°C	Diffusivity cm^2/sec	Expansion $10^{-6}K^{-1}$
DIAMOND IIa	**2,000 ~ 2,300**	**1.81**	**11.10 ~ 12.10**	**0.8 ~1.0**
CVDD	**1,300 ~ 2,000**	**1.81**	**7.20 ~ 11.60**	**0.8 ~ 1.2**
Cu	**397**	**3.44**	**1.16**	**16.0**
Al	**239**	**4.67**	**0.51**	**23.2**
W	**175**	**2.69**	**0.65**	**4.5**
Mo	**138**	**2.58**	**0.53**	**4.8**
Si	**139**	**1.71**	**0.81**	**2.6**
BeO	**260**	**9.44**	**0.27**	**6.3**
AlN	**170 ~ 220**	**2.38**	**0.80**	**4.0**

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PCD PROPERTIES VS. OTHER MATERIALS

Properties \ Material		Mono Diamond	Co PCD	Si PCD	PCBN	Si_3N_4	SiC	WC
Density	g/cm^3	3.52	3.80 | 4.10	3.40	4.00 | 4.20	3.20	3.00	15.00
Knoop Hardness	kg/mm^2	6,000 | 9,000	5,000 | 8,000	5,000	2,700 | 3,200	1,800	2,200	1,500
Toughness	$Mpam^{-2}$	3.4	6.1 | 8.9	6.9	4.1 | 7.2	6.4	4.0	11.0
Compression Strength	Mpa	2,000	7,700	4,200	3,800	6,800	7,000	5,400
Tensile Strength	Mpa	2,600	1,300	600	500	470	400	1,100
Thermal Expansion	$10^{-6}/℃$	0.8 | 4.8	1.5 | 3.8	3.8	3.5 | 4.2	3.5	3.8	4.3 | 5.6
Thermal Conductivity	W/mK	600 | 1,200	560	120	150	30	40	80
Friction		0.05 | 0.10	0.10	0.10	0.10	0.20	0.20	0.20

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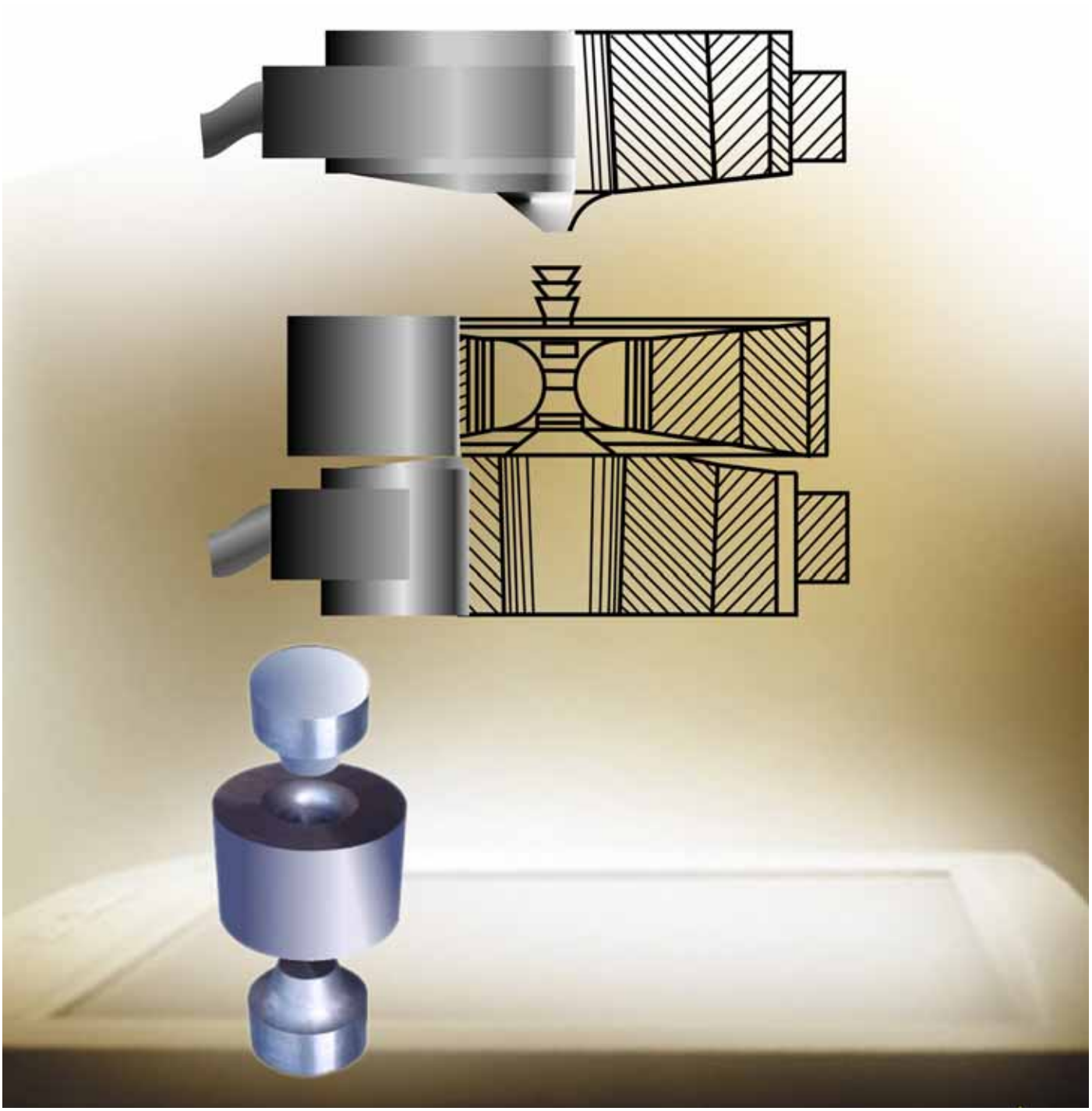
BELT TYPE



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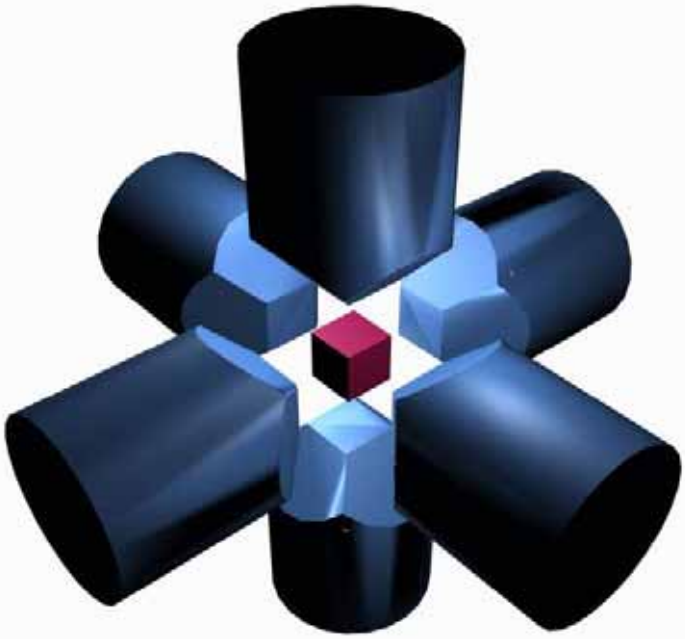
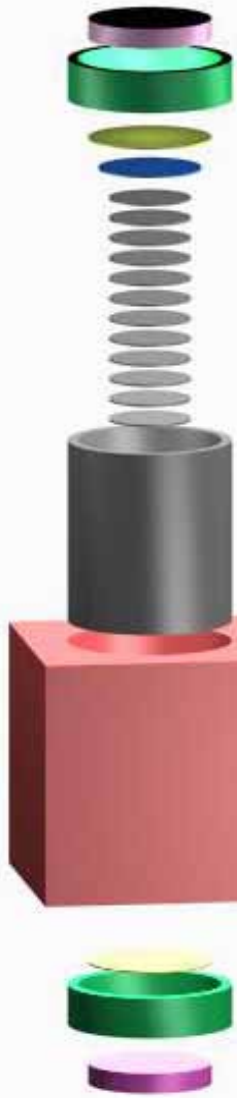
CUBIC TYPE





BUTTON

CONDUCTING RING

DISC

CATALYST INNER

GRAPHITE INNER

INSULATOR

PRESSURE TRANSMITTING MEDIUM

METAL DISC

CONDUCTING RING

BUTTON

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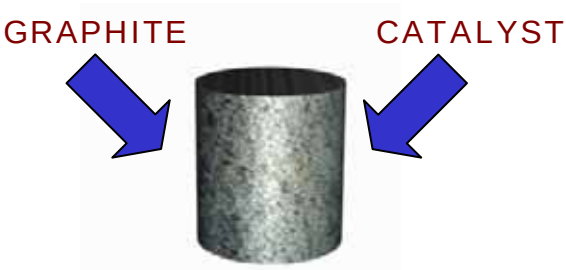
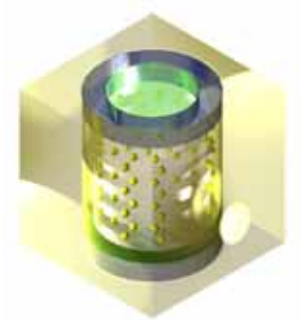
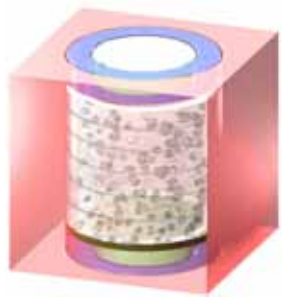
POWDER vs. DISC PROCESS



WELL MIXED POWDER OF
GRAPHITE & CATALYST BY CIP

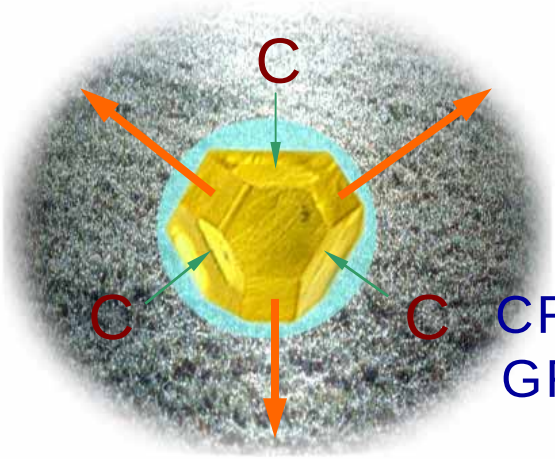
DISC TYPE OF
GRAPHITE & CATALYST



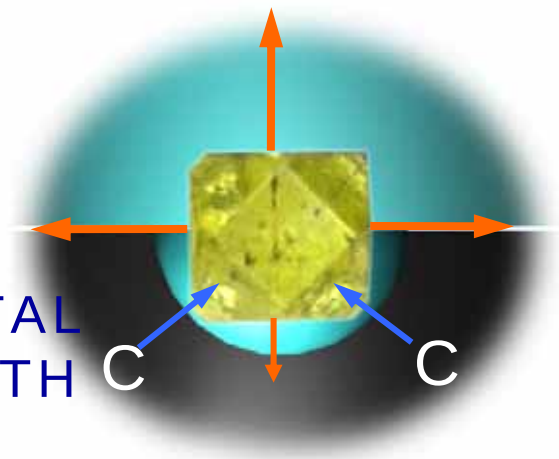


HPHT

3-D



2-D



CRYSTAL
GROWTH

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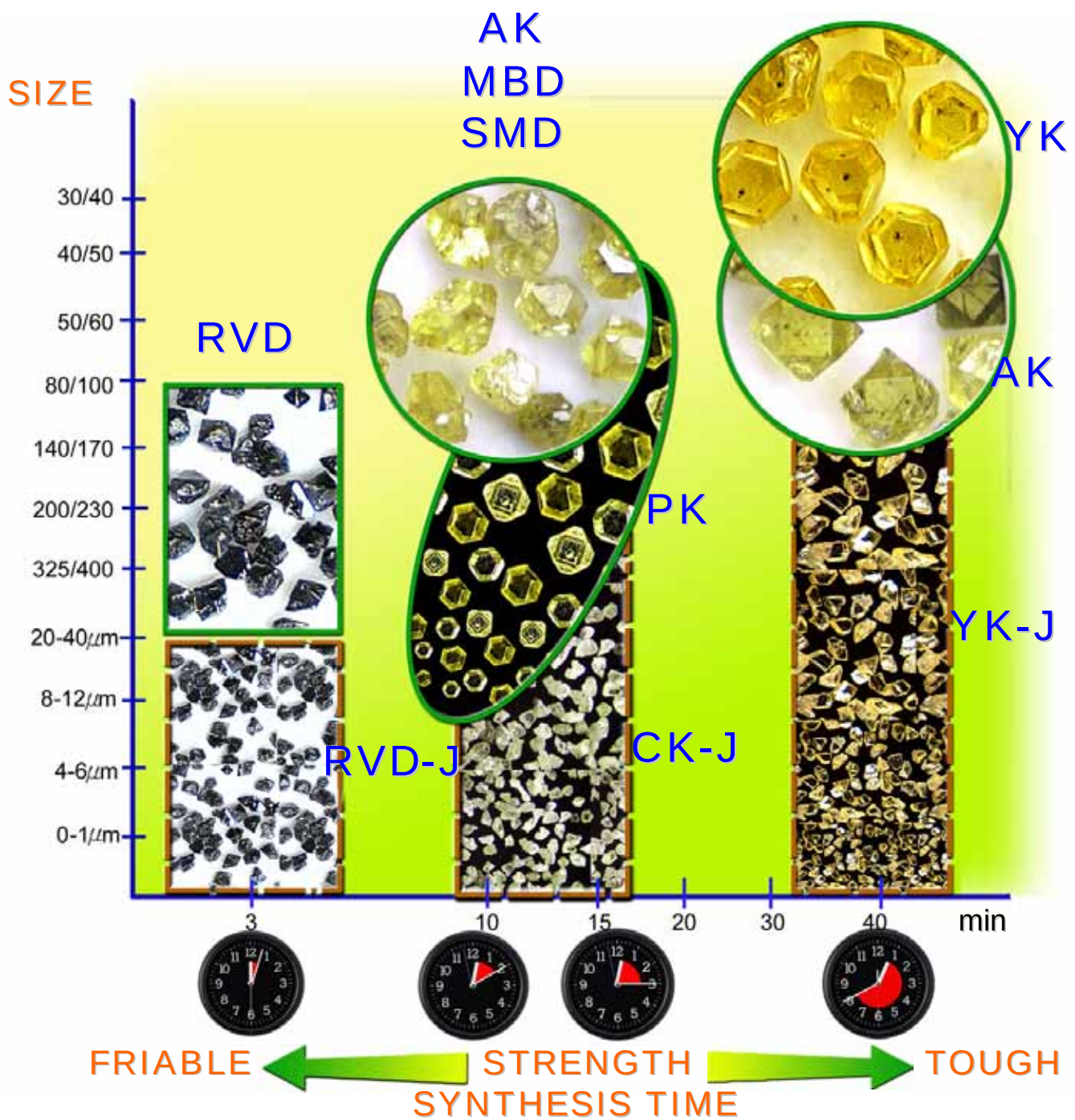
STRENGTH vs. SYNTHESIS TIME



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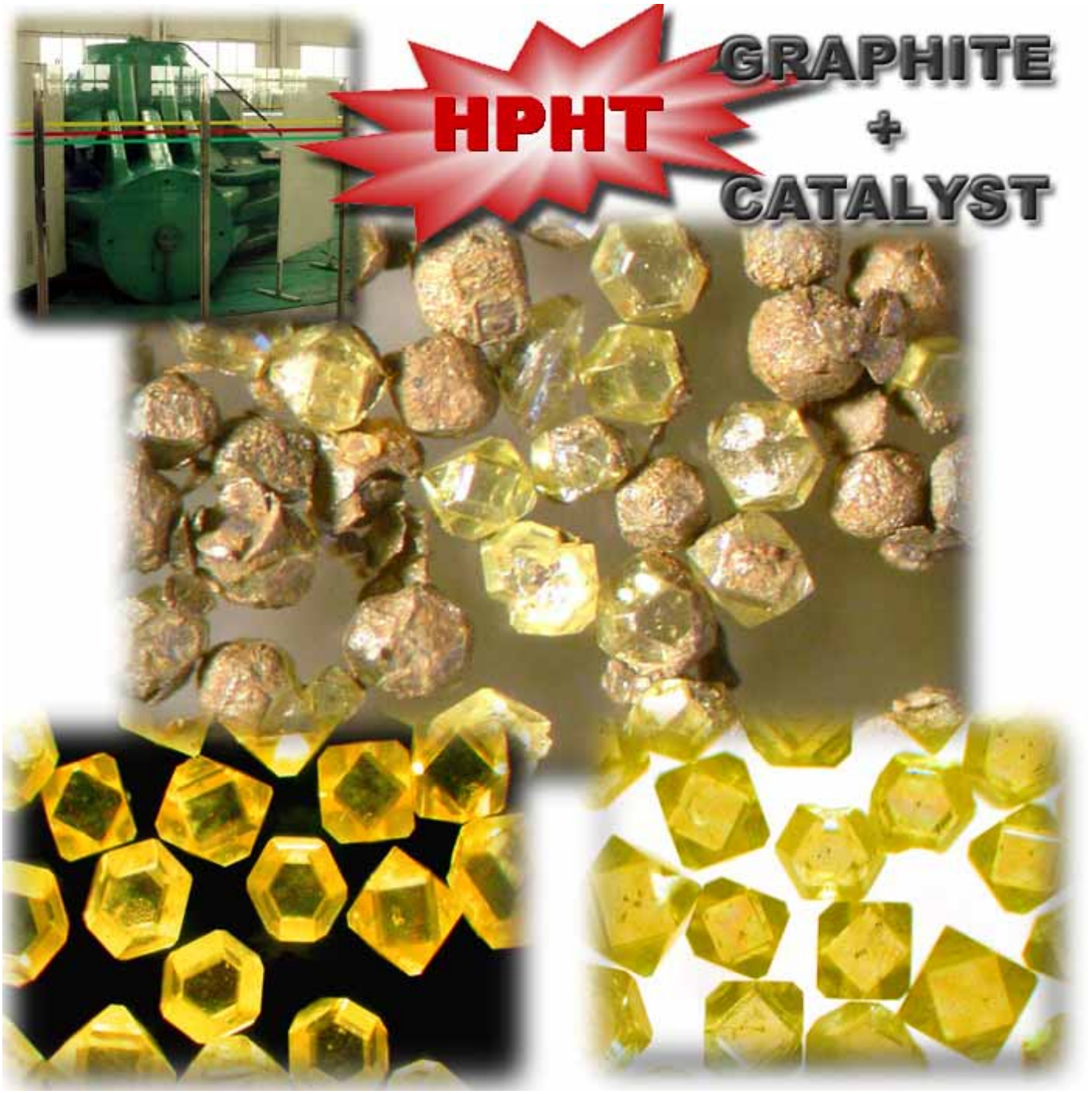
DIAMOND BABIES



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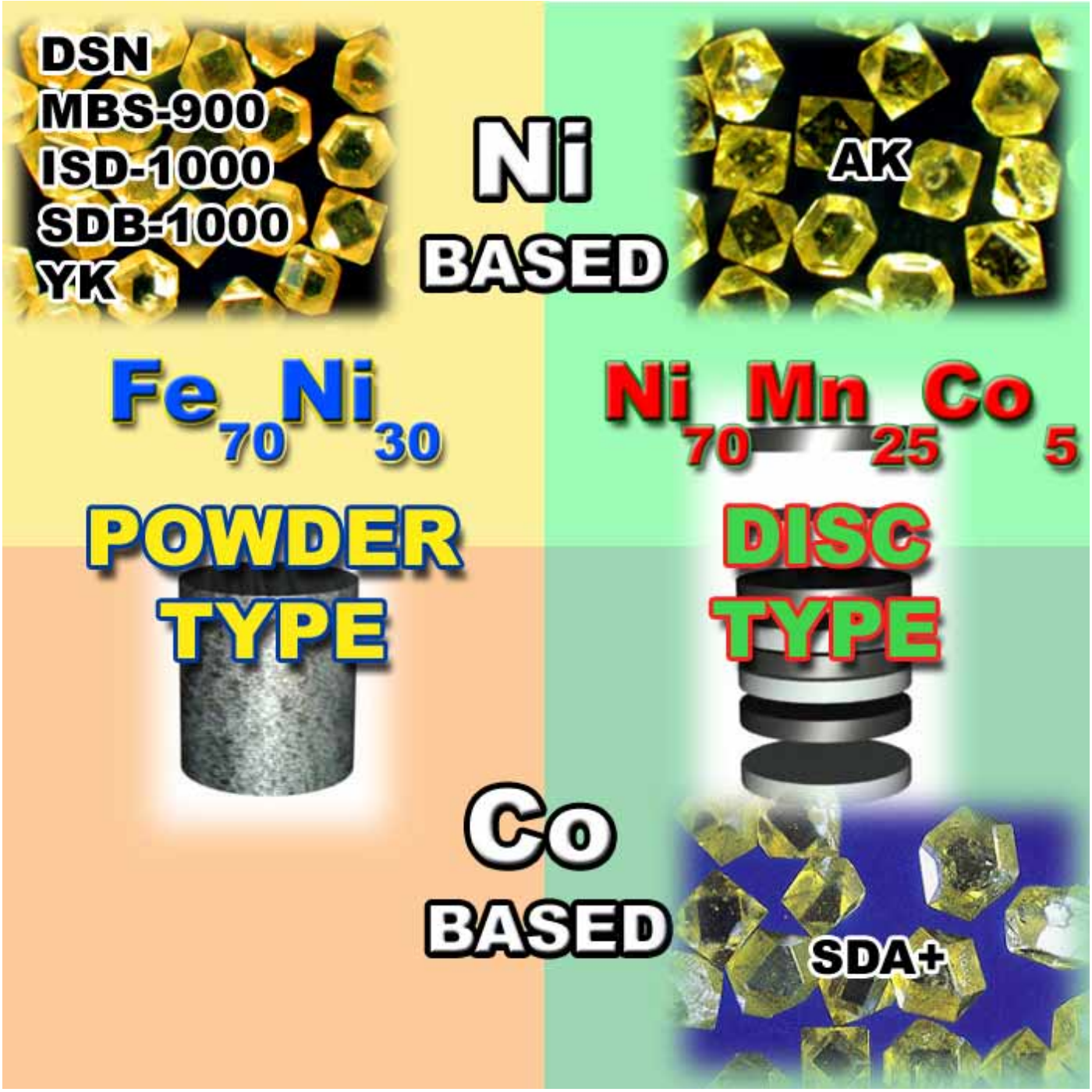
CATALYST FOR DIAMOND SYNTHESIS



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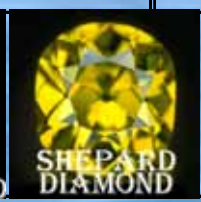
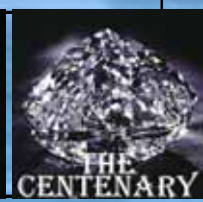
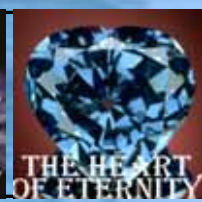
4 DIAMOND TYPES

TYPES		TYPE I			TYPE II	
		I_a	I_b		II_a	II_b
ABUNDANCE IN NATURAL DIAMOND		-98%	<0.1%		1~2%	<0.1%
SYNTHETIC DIAMOND		NOT SYNTHESIZED	SYNTHETIC POWDER	SYNTHETIC SINGLE CRYSTAL	SYNTHETIC SINGLE CRYSTAL	SYNTHETIC SINGLE CRYSTAL
IMPURITIES	NITROGEN (PPM)	~$2x10^3$	10^2~10^3	1~10^2	~1 HIGH PURITY	~1 PLATELET FORM
		PLATELET FORM	DISPERSED			
	OTHERS (PPM)	-	SOLVENT METALS 10^3~10^5	-	-	BORON ~100
COLORS		CLEAR-YELLOW	GREEN-BROWN	YELLOW	COLORLESS	BLUE
ELECTRIC RESISTIVITY (Ω. Cm)		10^4~10^{16}		10^{16}	10^{16}	10~10^4
		INSULATOR			-	SEMICONDUCTOR P TYPE
THERMAL CONDUCTIVITY (W/m*K)		800	800~1,600	2,000	2,000	-
PICTURES						
REMARK						

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FACT 2009

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