

# typical elements in ceramics

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn

# common properties of ceramics

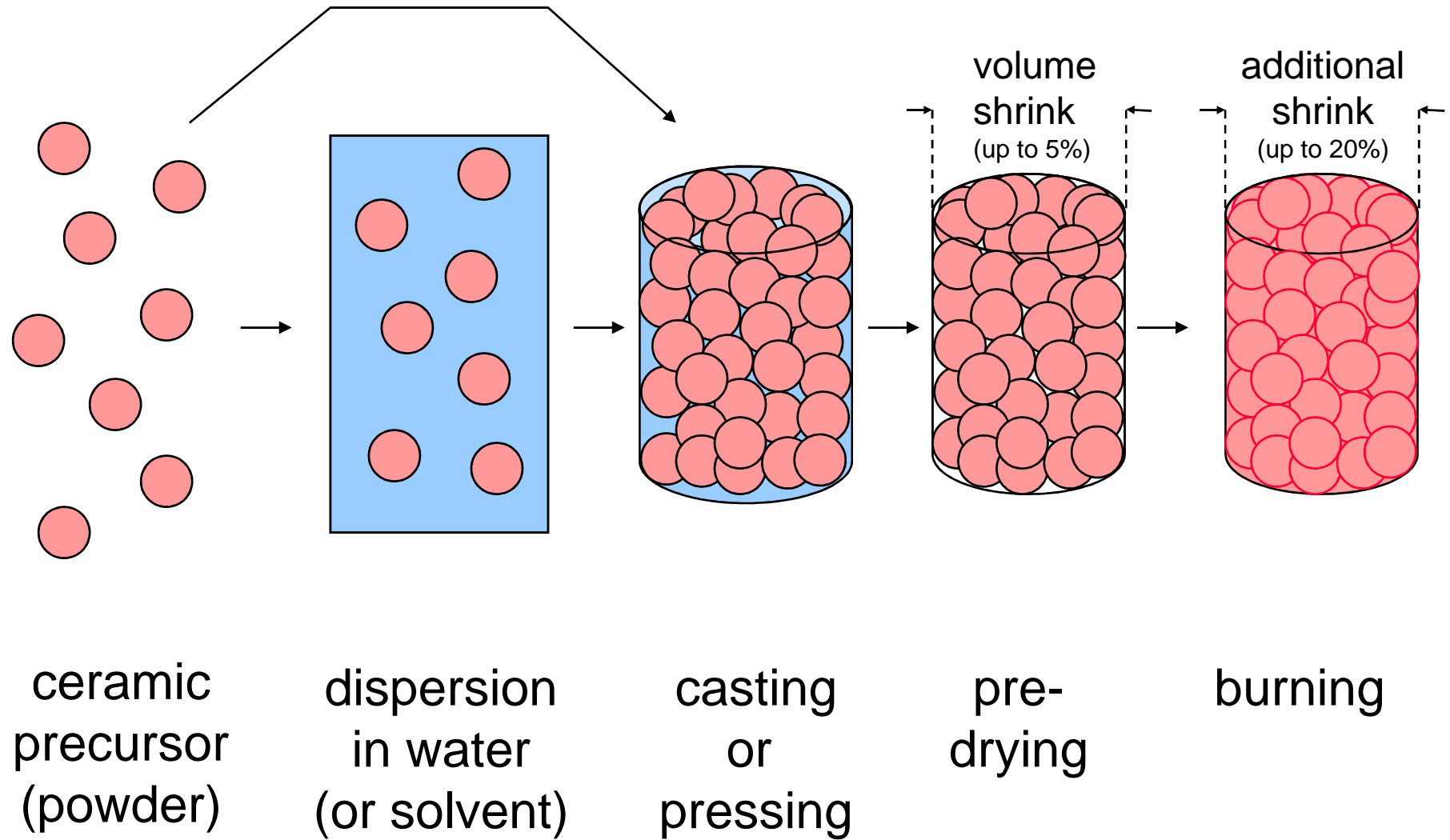
physical  
properties:

- extreme hardness
- low toughness, high brittleness
- high durability under friction, low wear
- very high temperature resistance
- white color in absence of pigments
- excellent electric isolators

chemical  
properties:

- high resistance against aggressive chemicals (except for very strong bases or HF)
- no corrosion, insignificant ageing

# production steps of ceramic materials



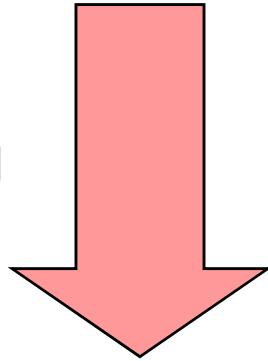
# chemical reactions forming ceramics

main component of clay:

**Kaolinite:**



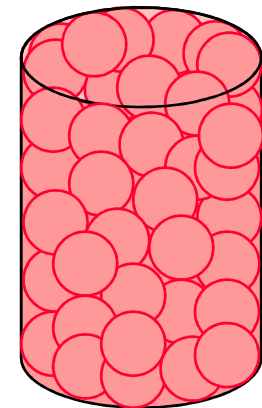
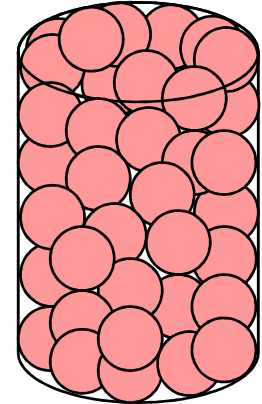
burning



- n H<sub>2</sub>O

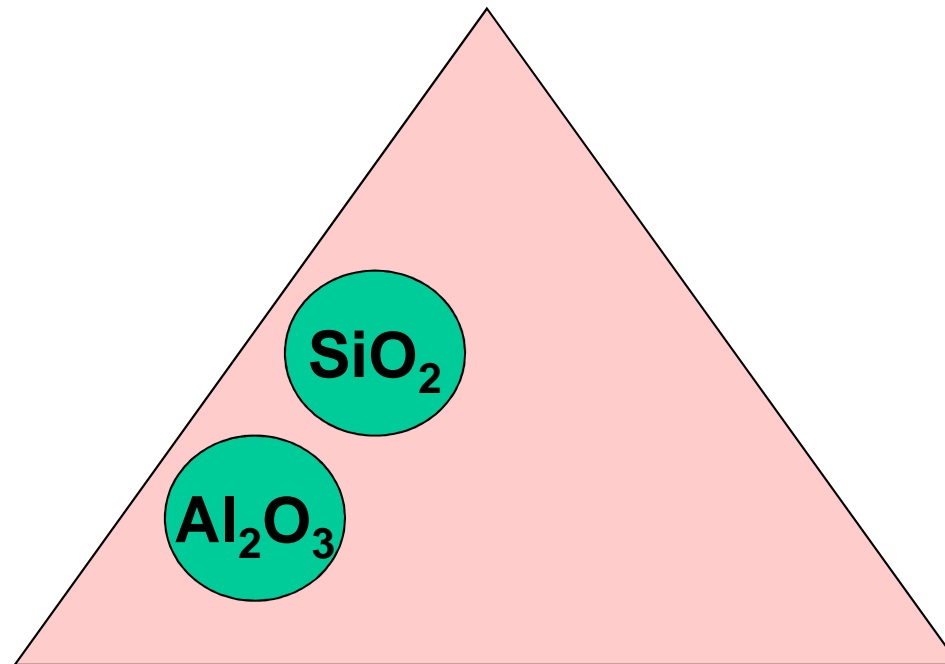


with n up to 2.



In reality, chemical bonds in real compounds exhibit different contributions of the ideal bond characteristics. Therefore, they have to be attributed to various positions in a „bond triangle

**covalent bond**



**ionic bond**

**metallic bond**

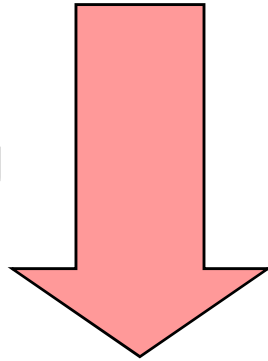
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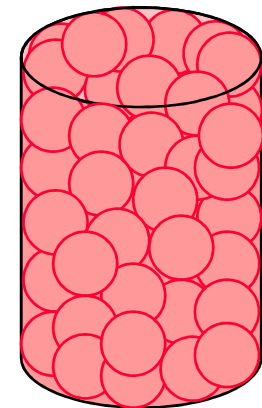
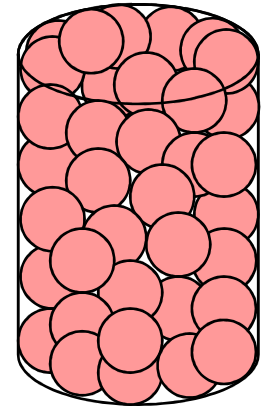
burning



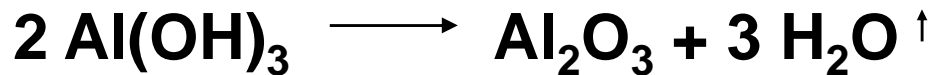
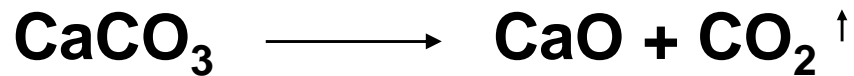
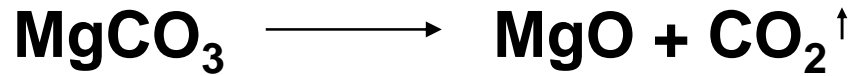
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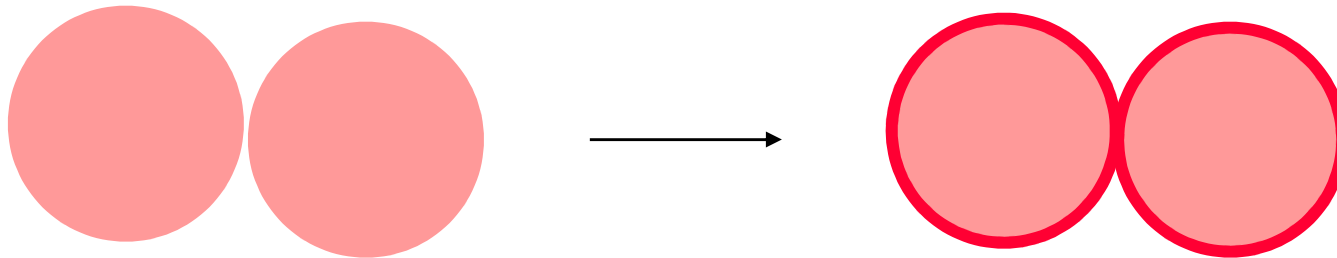
with n up to 2.



**other reactions:**



**in most cases, the reactions occur only on the particle surfaces, leaving the particle core unchanged:**



**the reaction products bind the particles together, finally forming a compact solid material**