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ROLL NO:- 71
SUBJECT:- EMM
MTRX

1. Explain toughening mechanics in ceramics.

→ Ceramics are now more brittle than most metals and plastics. The irrersible work associated with plastic deformation is not presented is ceramics. Hence, the methods that improve the toughness of ceramics are different from metals. These several toughening mechanism called crack deflection, micracrack toughening, transformation toughening and crack bridging.

→ Crack deflection:- In polycrystalline ceramics, the crack can propagate in an intergranular way. The associated irrersible work per unit area is $2\gamma - \gamma_b$ where γ is the surface energy of material and γ_b is the grain boundary energy. Tough the irreversible work is decreased because of grain boundary energy, the fracture area is increased in intergranular crack propagation, which further improves the toughness of ceramics.

→ Microcrak toughening:- Microcrack toughening means that the formation of microcrack before the main crack can toughen. The ceramic.

Additional microcracks will cause stress to concentrate in front of the main crack. This leads to additional irreversible work required for crack propagation.

Transformation toughening: Partially stabilized zirconia is composed of tetragonal phase at high temp and monoclinic phase and cubic phase at lower temp. in equilibrium. In some components, the onset temp, in equilibrium, of tetragonal monoclinic martensite transformation at velocities hypothesized to approached at that of sound in the material.

Crack Bridging :- When a crack propagates in an irregular path, some grains of each side of main crack may protrude into other side. This leds to additional work for a complete fracture. There are some other approaches to improve the toughness of ceramics through crack bridging

12) Compare ceramics with metals with regards to their properties and structure.

→ Comparision metals Vs Ceramics.

METALS	CERAMICS
1) Large no. of free electron.	1) Captive electrons.
2) Metallic bond.	2) Ionic / covalent bond is present non conducting.
3) Uniform atoms	3) Different size atoms
4) High tensile strength	4) Poor tensile strength
5) Good ductility	5) Poor ductility
6) Impact strength	6) Impact strength is poor.
7) Relatively high weight	7) Lower weight
8) Moderate hardness	8) Extreme hardness
9) Good electrical conductivity	9) Poor conductivity.