

Superconductivity

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Why in news?

Researchers of IISc have recently reported that they have achieved superconductivity at room temperature.

What is Superconductivity?

- Electricity is essentially free electron movement in materials such as copper.
- The passage of electrons in a conducting medium is spontaneous and haphazard in one particular direction.
- They often connect with each other and also other particles in the material and therefore causes resistance to current flow.
- **Superconductivity is a state in which there is virtually no electrical resistance in the material.**
- Superconductivity allows unimpeded movement of electrons which is only possible at extremely low temperatures, i.e in the 100 ° C range below freezing.
- Another property of a superconductor, is the Meissner effect- i.e the magnetic fields are excluded.
- John Bardeen, Leon Cooper and Robert Schrieffer modelled the absence of electrical resistivity in the form of electron mixing in the crystal grid (BCS principle).

Significance:

- Super-conductors built with room temperature are highly efficient in terms of both energy and cost savings.
- With the introduction of MRI devices superconductors have reduced the number of exploratory surgeries.
- The phenomenon of superconductivity, which has until now only happened at extremely low temperatures, is 100 ° C below zero.
- The researchers from the IISc recently shared a video

that shows clear evidence of diamagnetism at ambient temperature and pressure.

- The team claimed to have achieved superconductivity at ambient temperature and pressure.
- Though superconductors will help build very high efficient devices leading to huge energy savings, it has not been possible to exploit it for everyday use as till now scientists had been able to achieve superconductivity only at temperatures far below 0°C.
- Hence the new discovery of IISc team, which has been able to achieve superconductivity at ambient pressure and temperature of 286 K (13°C) will be a huge breakthrough if the work stands the test of time and other groups succeed in reproducing the results.