

EDFA - Erbium-doped fiber amplifier



Rare element

atomic no. - 68

Er^{3+} ions form is doped in optic fiber in

the EDFA unit

↓ silica glass

Stable form

Doping is done via MCVS $\Rightarrow$ Modified Chemical Vapor Deposition process

Along with "solution doping" (Impregnation)



In this ErCl_3 is added to solvent, generating Er^{3+} , soot layer formed by MCVS, absorbs the Erbium.

Post that drying, it is returned to MCVS lathe.

I'm skimming that part because I was just interested in how the ion

form achieved and used in doping.

Now energy levels which is core to how the reaction happens to generate the identical photons to boost signal.

$E1 \rightarrow$ lowest energy band $\rightarrow Er^{3+}$

When the pump laser light enters the Er ions absorb energy and jump to $E3$ (highest excited state)

Then $E3 \rightarrow E2$ is quick decay, that's the metastable state, ions stay in that state for longer.

Population inversion { Since continuous pumping happens, more and more ions are in $E2$, meaning the equilibrium is no longer there which essential for having a reaction

Now a weak photon from the incoming optical signal, encounters the Er ion in $E2$ state

it stimulates that ion to E_1 , as that happens
it emits an additional photon that
is the exact replica of the stimulating
photon.