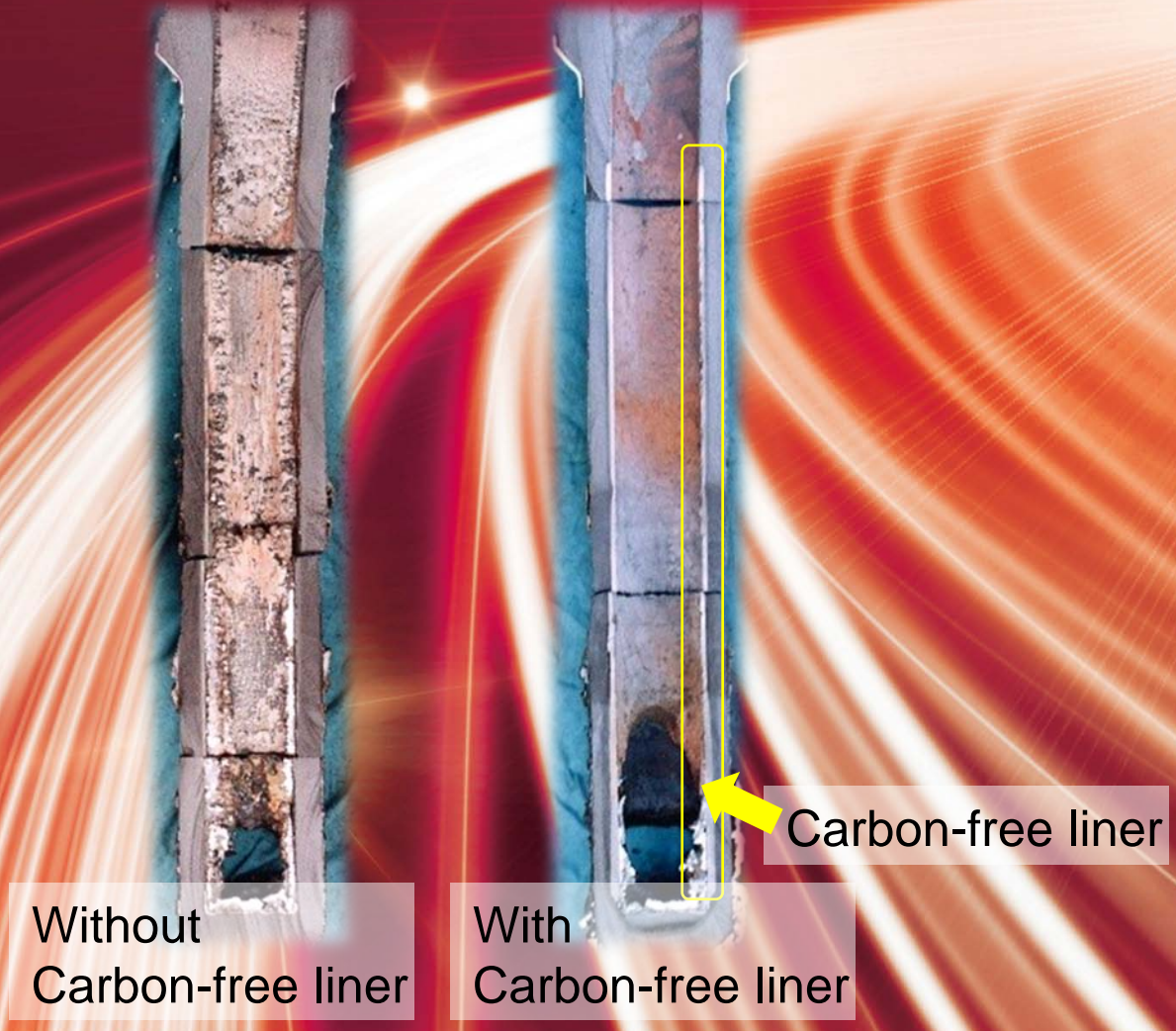


# Carbon-free liner

Inner material of Submerged Entry Nozzle



**Carbon-free liner prevent clogging of alumina at the inner bore surface**  
(White thin layer is carbon-free liner).

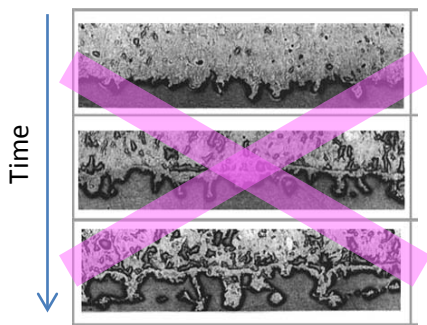
Carbon-free liner material . . .

- ✓ helps stable casting operation.
- ✓ prolong service life of SEN.
- ✓ keep original flow pattern in the mold.

# Feature of carbon-free liner material

- Carbon-free liner material have the following advantage over alumina-graphite materials.

Retaining surface flatness in molten steel ··· No decarburization



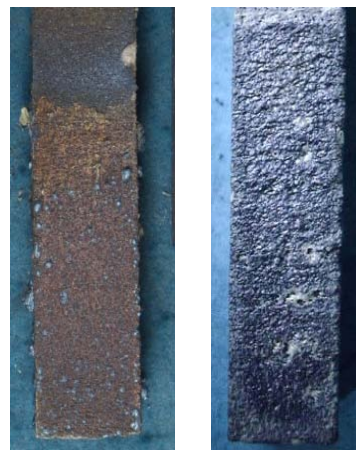
Carbon –contained material (ex. alumina-graphite)  
The surface condition becomes rough by decarburization.

Eliminate source of oxygen; SiO(g), CO(g) ··· No reaction SiO(g), CO(g) and Al  
Suppression of heat loss through refractory

- These properties are advantageous for alumina clogging prevention.



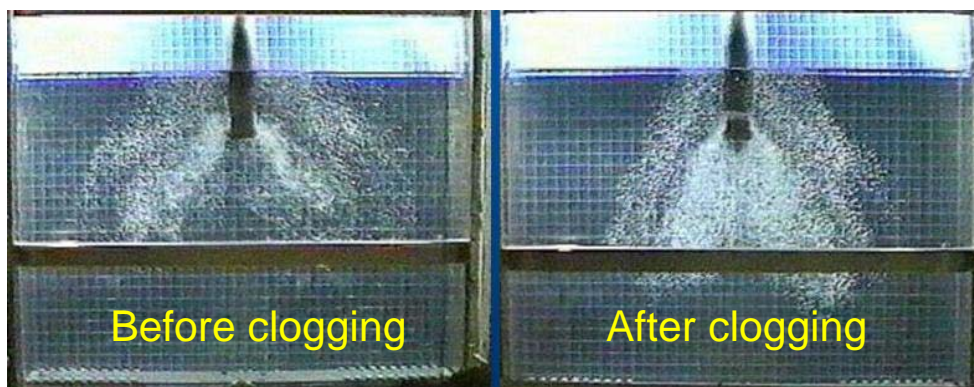
Alumina-graphite material



Carbon-free material

Result of alumina clogging simulation test

- A SEN without clogging can keep initial outlet flow pattern in the mold.  
(The direction of the outlet flow becomes downward after clogging.)



Outlet flow direction change to downward