

**Coatings**

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# MHD coating

- **For a self-cooled liquid metal blanket, an almost perfect coating is necessary.**
- **There is no design window for the IB of a Tokamak if coating can not be developed.**
- **The key reason for the MHD coating is to**

**reduce the stress in the structure.**

- **Pumping power is usually not an issue.**

# **The issues on coating**

**The issues on coating are not well understood, which includes the following list:**

- How to form the coating.**
- Chemistry control.**
- Radiation effect.**
- Thermal cycling.**
- Life limit.**
- Compatibility with Li and V.**
- Compatibility with other blanket functions.**
- Allowable cracks.**

- **Regeneration kinetics.**
- **Time constant for regeneration.**
- **Effect of mass transfer due to the flowing system.**

**The development of a MHD coating for the self-cooled liquid metal blanket is one of the most challenging problems in fusion technology.**

**There is no assurance if an acceptable coating can be developed.**

# A suggestion

- At this time, O is pre charged into V-alloy.
- The O balance on the surface of the V is an issue.
- Ca is dissolved in the Li to assure the stability of the CaO layer.
- The chemical reaction is
$$2 \text{CaO} \text{ ---} \rightarrow 2 \text{Ca} + \text{O}^2$$
- Thus, we will need both ca and O in the lithium to assure CaO stability.
- Only Ca in the Li will not assure CaO stability, from

**thermodynamics point of view.**

- **This suggestion was made by Park from ANL.**
- **Also, it is easier to control O in the Li, and it will not diffuse into bulk V.**

**Other coatings**

- **The MHD coating, if is developed, will be acting as the compatibility coating.**
- **The stable temperature of the MHD coating will be the limiting temperature for the material/coolant combination.**
- **Tritium permeation issues can be resolved by ways other than coating.**
- **Tritium permeation coating is not effective.**

