# CONTACT ANGLE MEASUREMENT OF MOLTEN LEAD-LITHIUM ON SILICON CARBIDE SURFACES

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In general, when a flow has a very thin momentum boundary layer on a hydrophobic or super-hydrophobic wall, the flow experiences a "flow slip" on the wall. Regarding a fusion blanket such as a dual-coolant or self-cooling liquid metal blanket, a liquid metal flow under a strong magnetic field is affected by magneto-hydrodynamic (MHD) forces. The theoretical and numerical study [1] indicated that MHD flows in channels of the poor wetting walls experienced the flow slip at the wall and eventually received the additional disturbances due to the MHD flow instabilities. This will increase the MHD pressure drop and affect on the heat and mass transfers in the fusion reactor blankets. There are several experimental studies regarding the wettability of the molten eutectic lead-lithium (PbLi) against a silicon carbide (SiC) plate which has qualitatively demonstrated the poor wettability over a long period of time.

The present study focused on a contact angle measurement as one of the fundamental features regarding the wettability related to the flow slip. However, a contact angle cannot be directly interpreted by the slip length which is a parameter normally quantifying flow slips defined as the distance from the liquid to the surface within the solid phase. The interfacial-phenomena regarding the relation between contact angle and slip length are not well understood until today. Nevertheless, a contact angle can be a quantitative measure of the MHD "slip" flows because it is considered the MHD "slip" flows will not occur at the hydrophilic surfaces. In addition to it, a laser-fusion modular power plant of "KOYO" design adopts a liquid-metal (PbLi) film flow along the first wall made of a SiC [2]. The present contact angle database can contribute to the numerical studies of the PbLi film flow behaviors along the SiC wall because the numerical simulations require the contact angle values.

In the present experimental study, contact angles of molten PbLi droplets put on the various SiC surfaces, such as a chemical vapor deposition (CVD) SiC and nano-infilteration and transient eutectic-phase (NITE) SiC, were measured in an inert atmosphere under 1 ppm both in oxygen concentration and humidity. The contact angle were measured in the droplet temperature from 250 deg-C to 400 deg-C on the raw-SiC surface and the surface-polished SiC surface, respectively.
As results, the contact angle database of molten PbLi was established. According to this database, it is found that the coupling of the molten PbLi and SiC surfaces is a super-hydrophobic. These results suggest the MHD "slip" flows may occur under the strong magnetic field, such as the fusion reactor blanket condition.

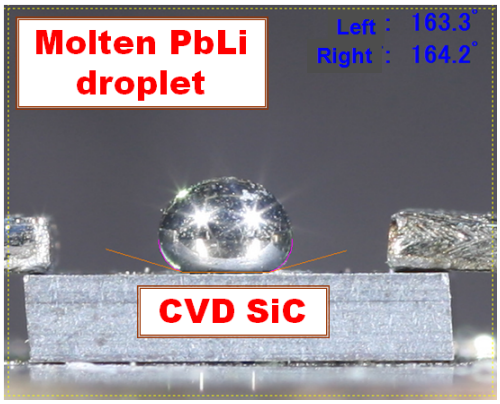


*Figure 1: a molten PbLi droplet on a monolithic CVD SiC*

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