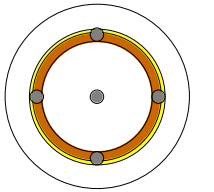
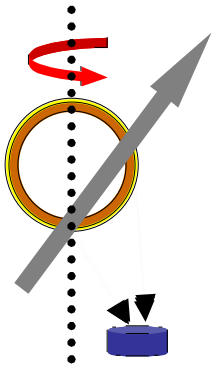
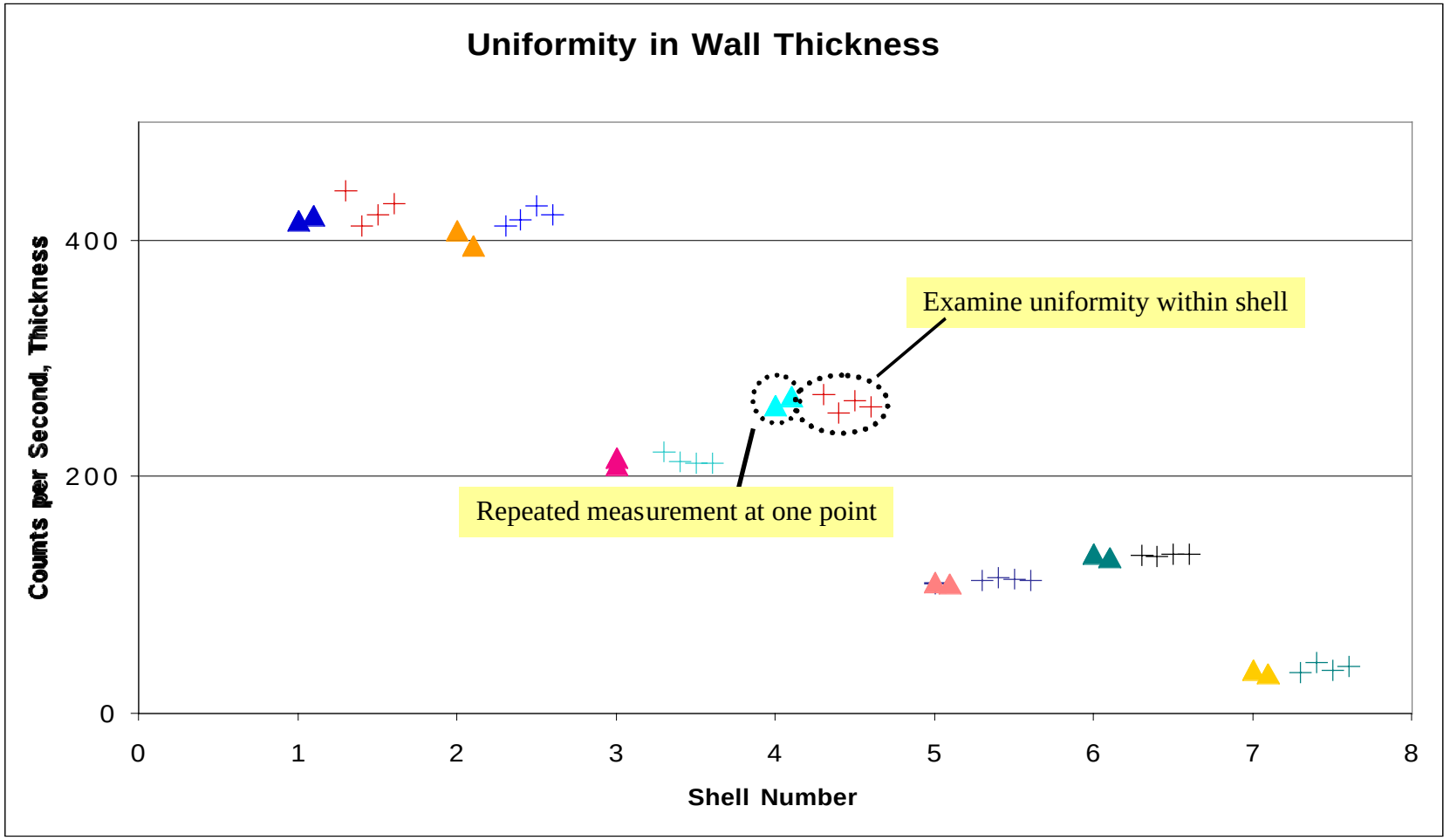
Palladium Coated Shells

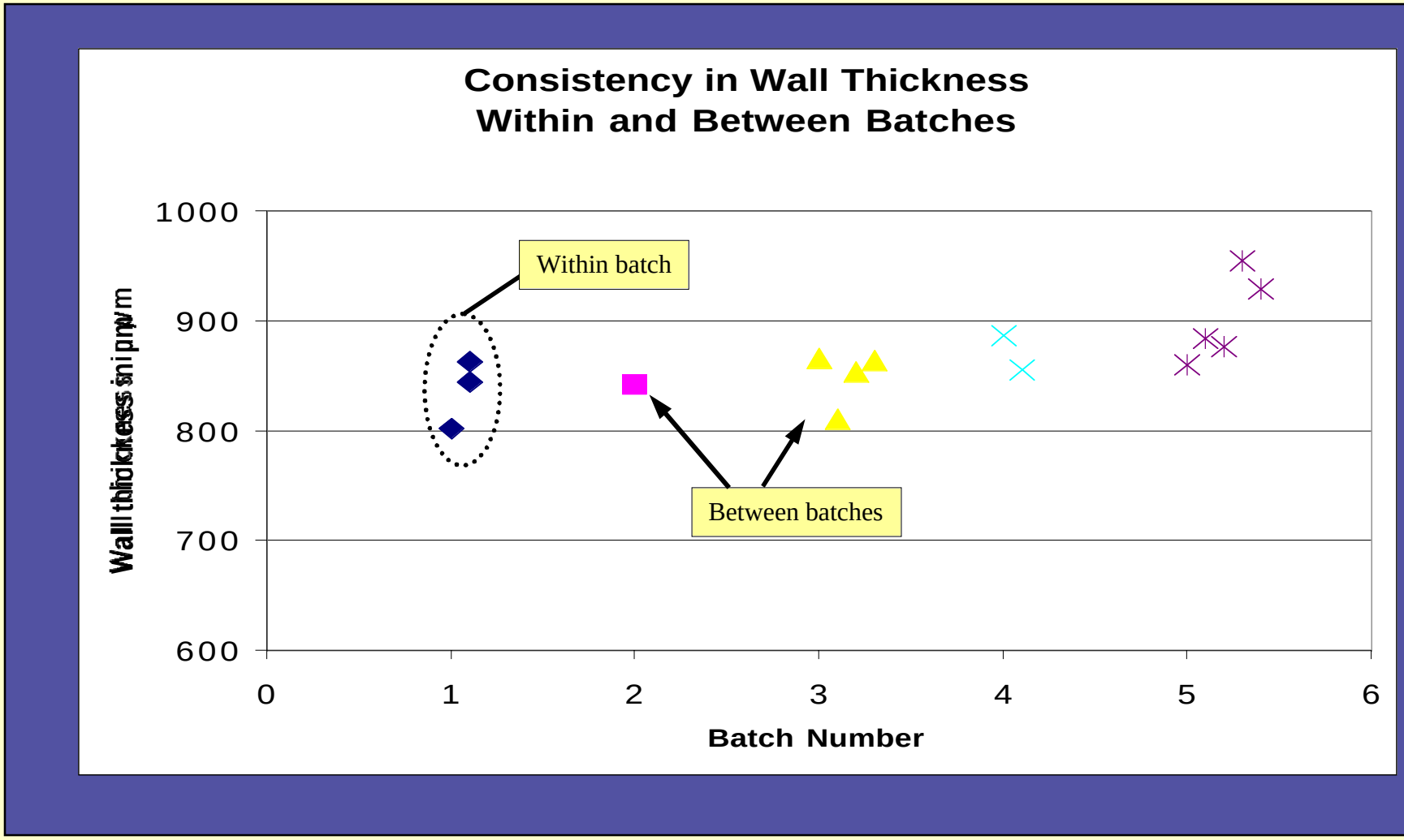
Uniformity of individual shell is within measurement error



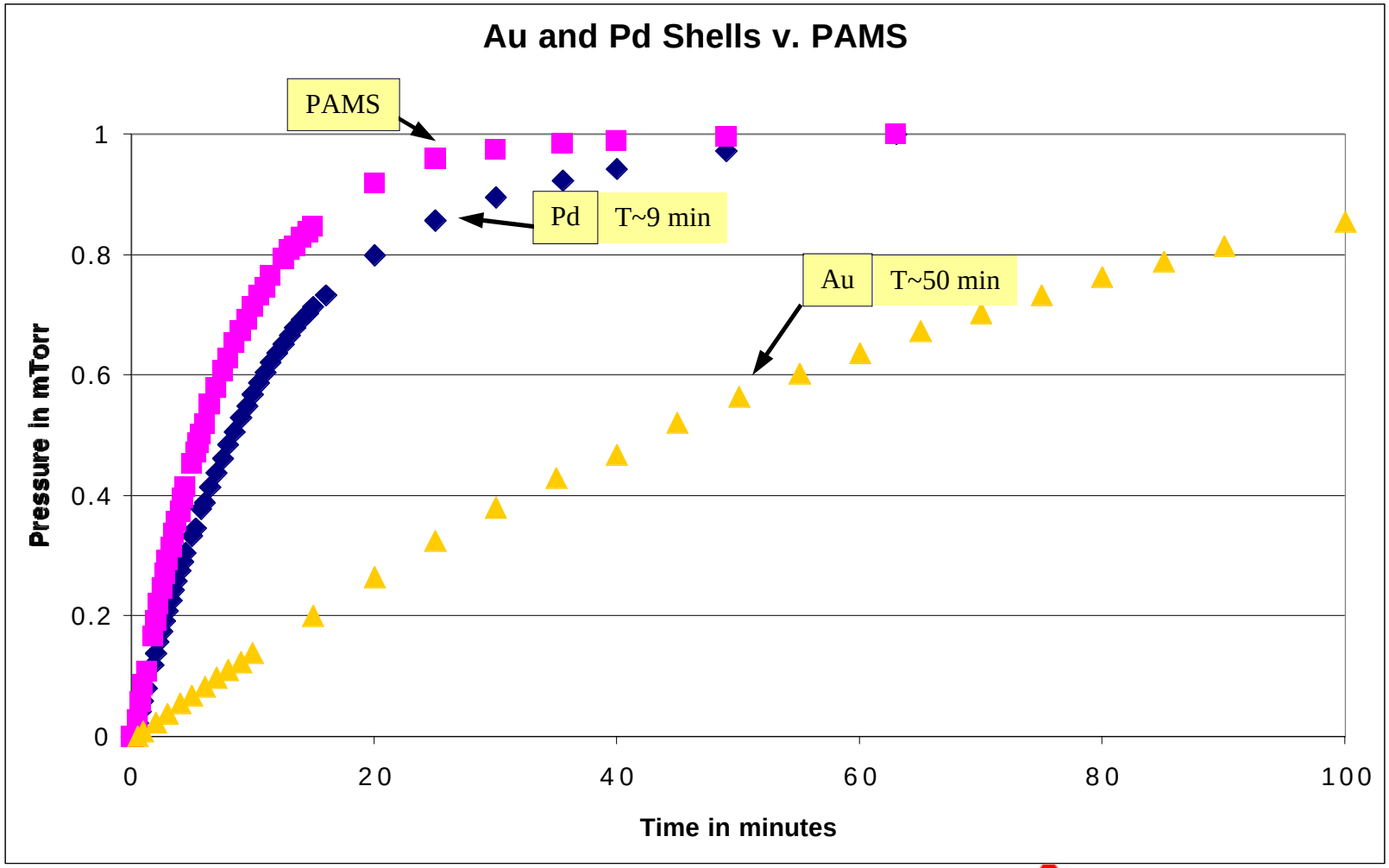




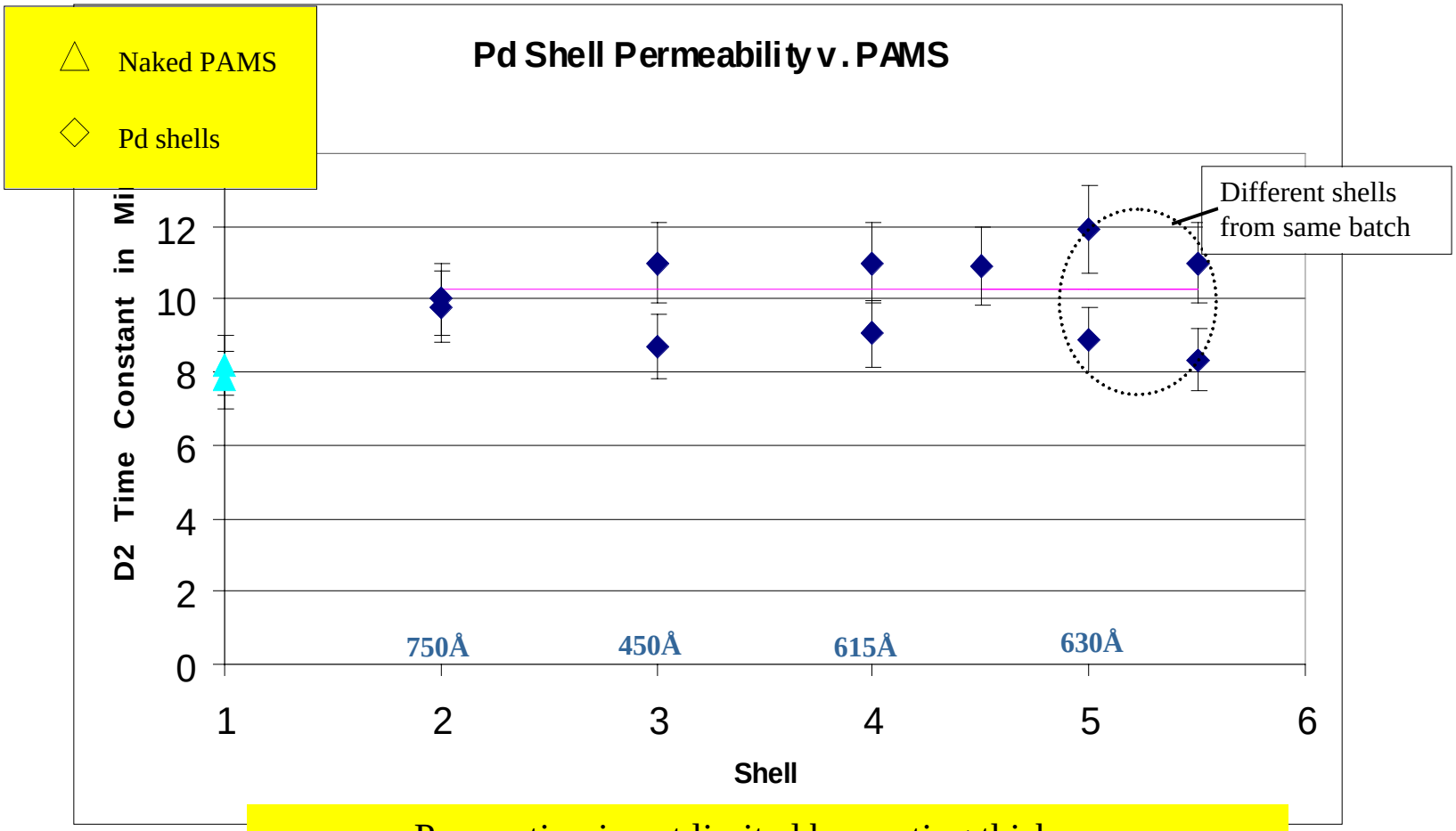
Shell to shell uniformity and batch to batch reproducibility is good



Pd coatings are significantly more permeable to D_2 than Au



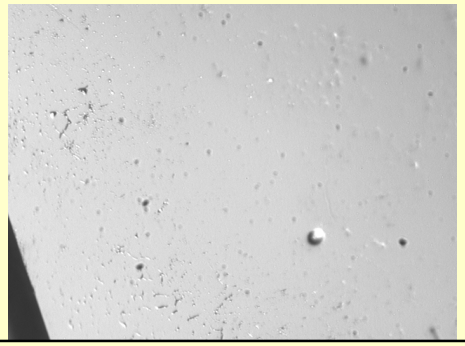
D_2 permeability of Pd coated shells appears independent of coating thickness



Permeation is not limited by coating thickness
Dissolution into metal the bottle neck?

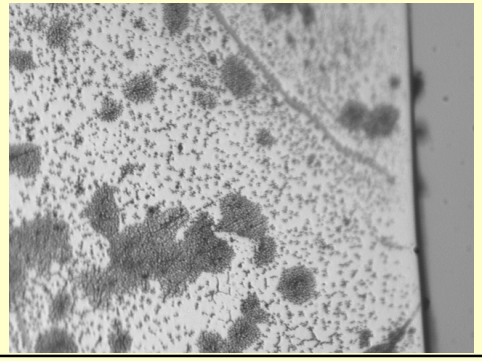
Pd exposure to D_2 causes cracking of films deposited on flat glass substrates

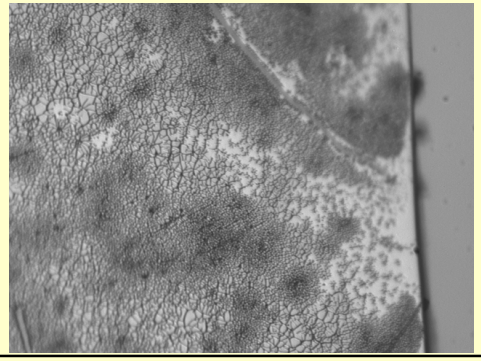
Before

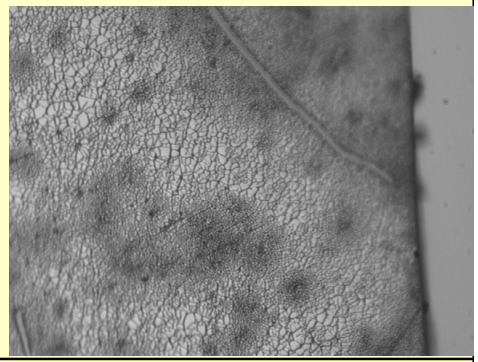


time ~ few minutes
390Å Flat exposed to D_2

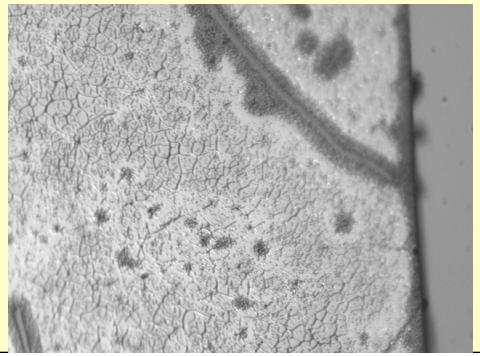
D_2 turned on

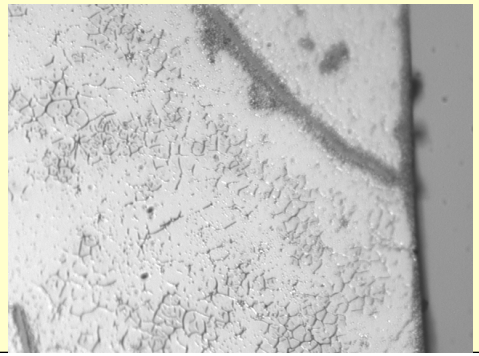


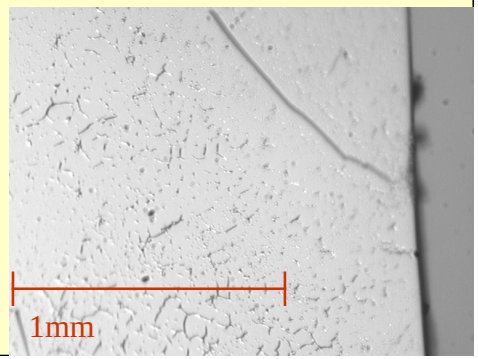




D_2 turned off

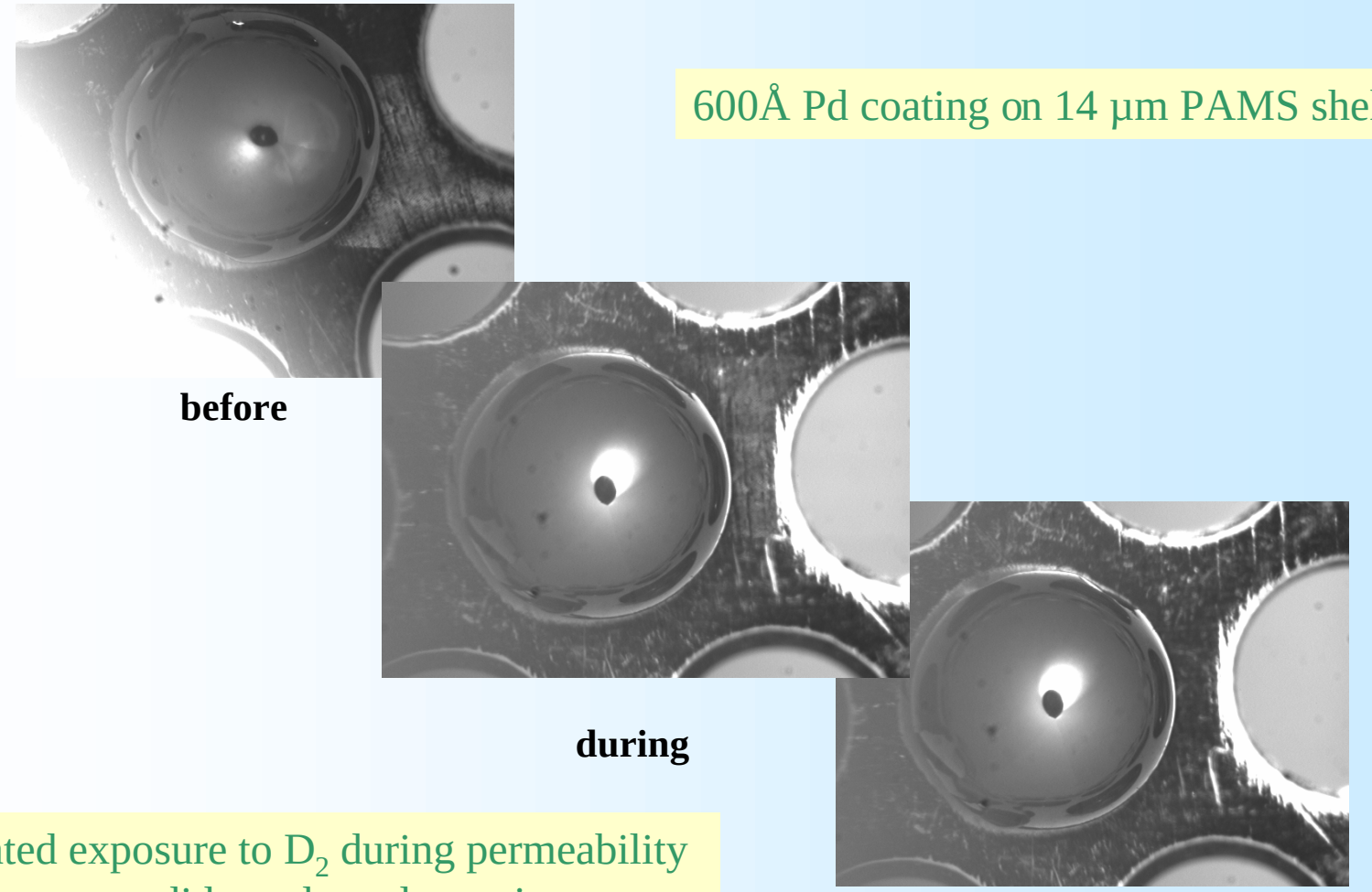






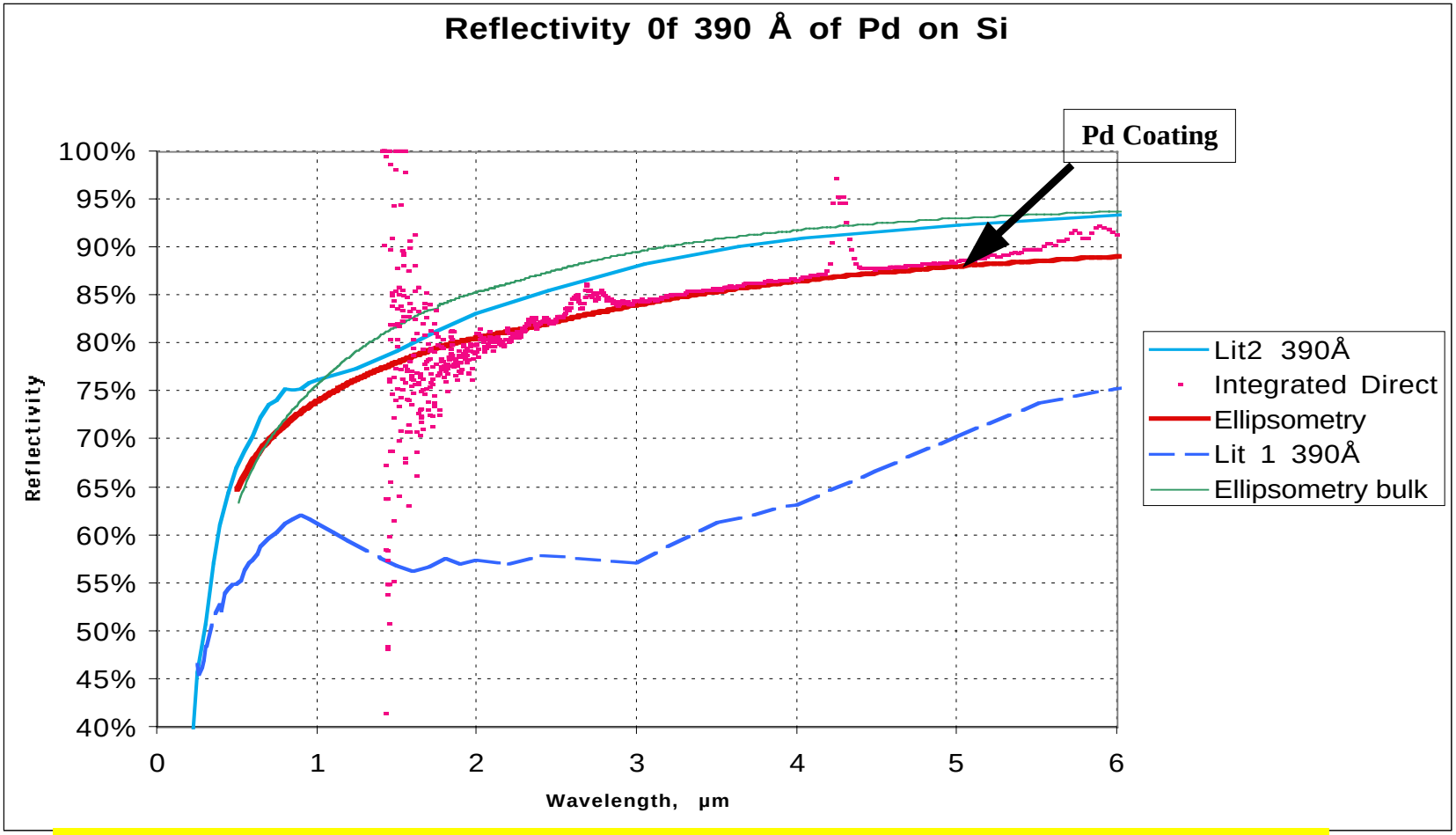
Pd coated shell exposed to D_2 exhibits no deformation

600Å Pd coating on 14 µm PAMS shell



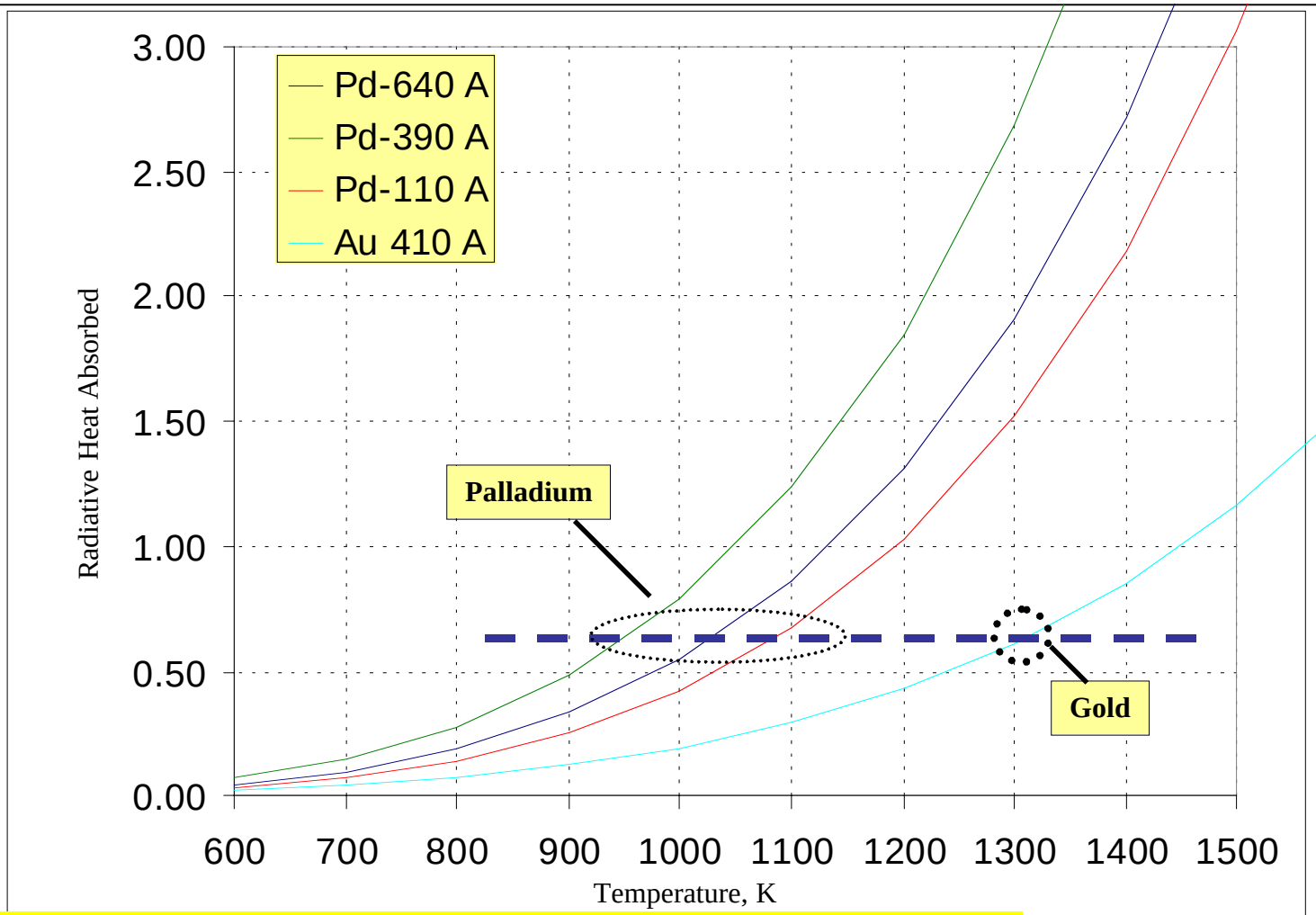
Repeated exposure to D_2 during permeability measurements did not degrade coatings.

Reflectivity of Pd coating is close to highest literature value



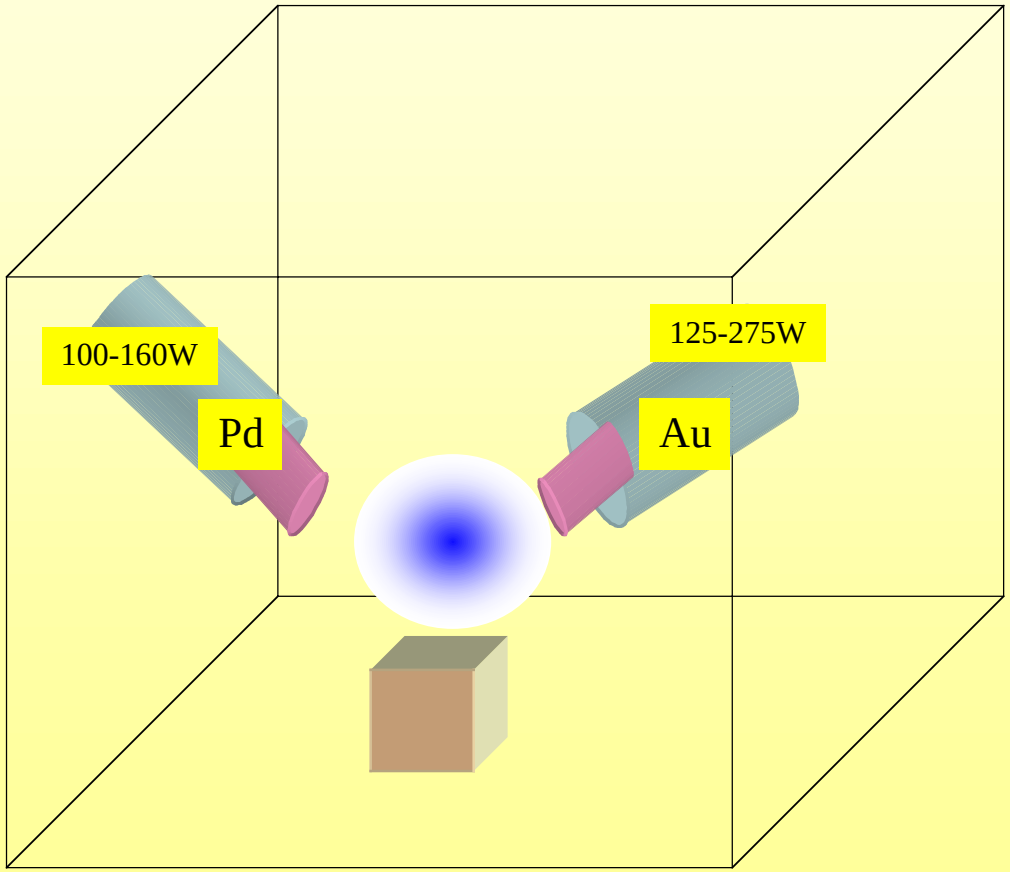
We found significant variation in literature values for Pd optical constants
Fabrication and measurement methods are variable

Chamber temperature has to be lowered for palladium coated shells

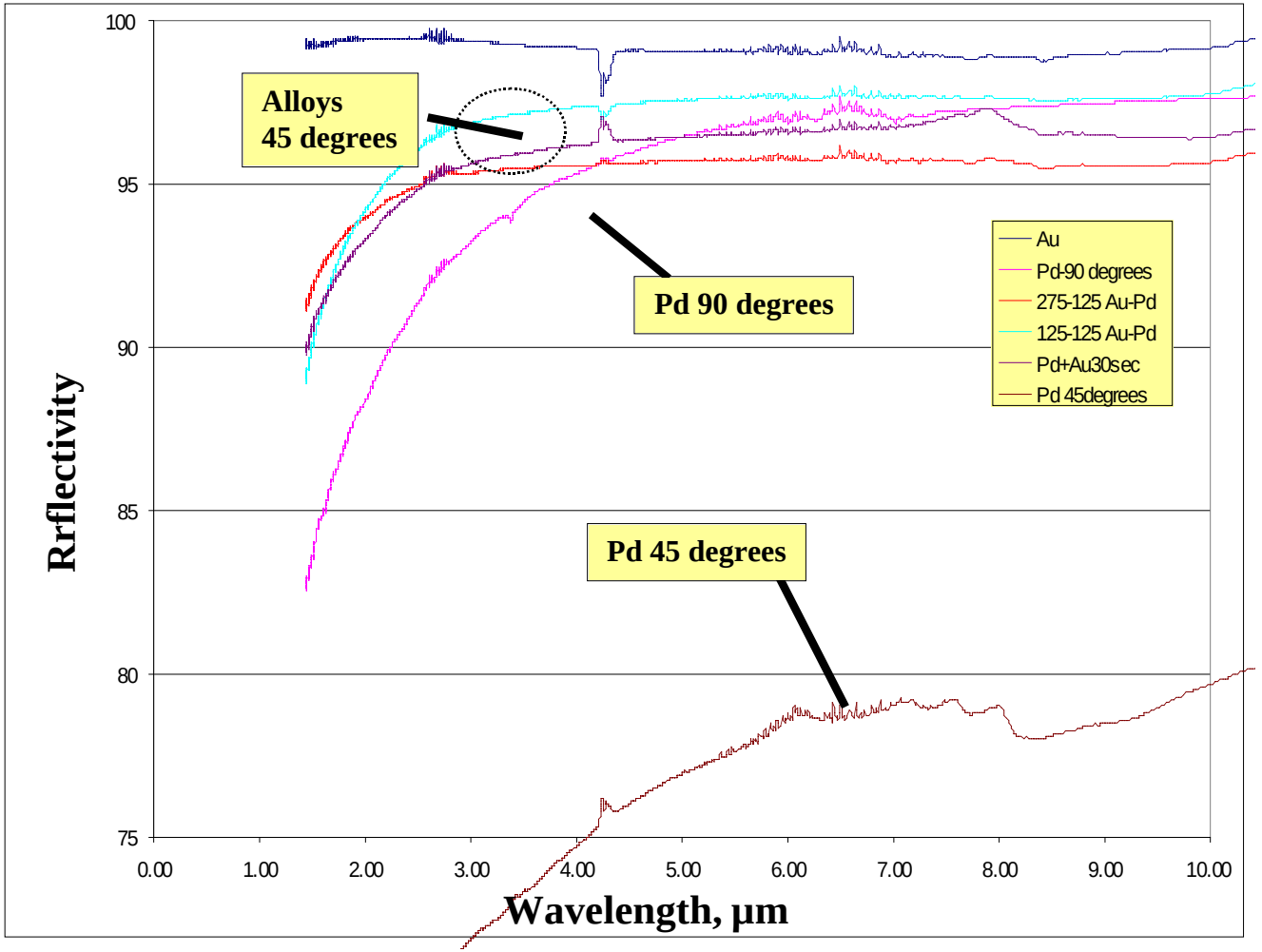


Will Au-Pd mixtures be more reflective but still permeable?

Pd/Au Mixture: Co-Sputtering Technique

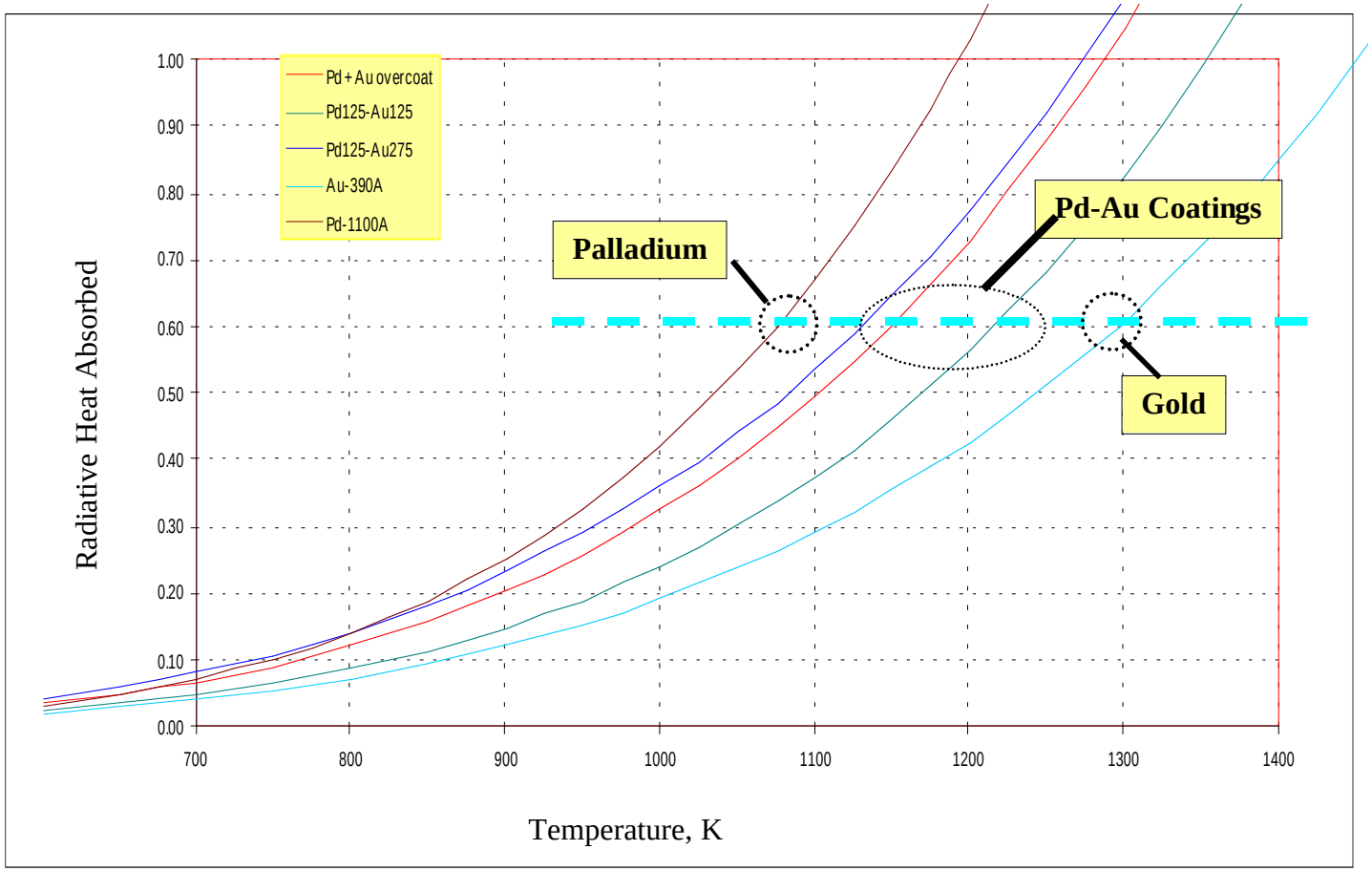


Addition of Au does increase the reflectivity of Pd coatings

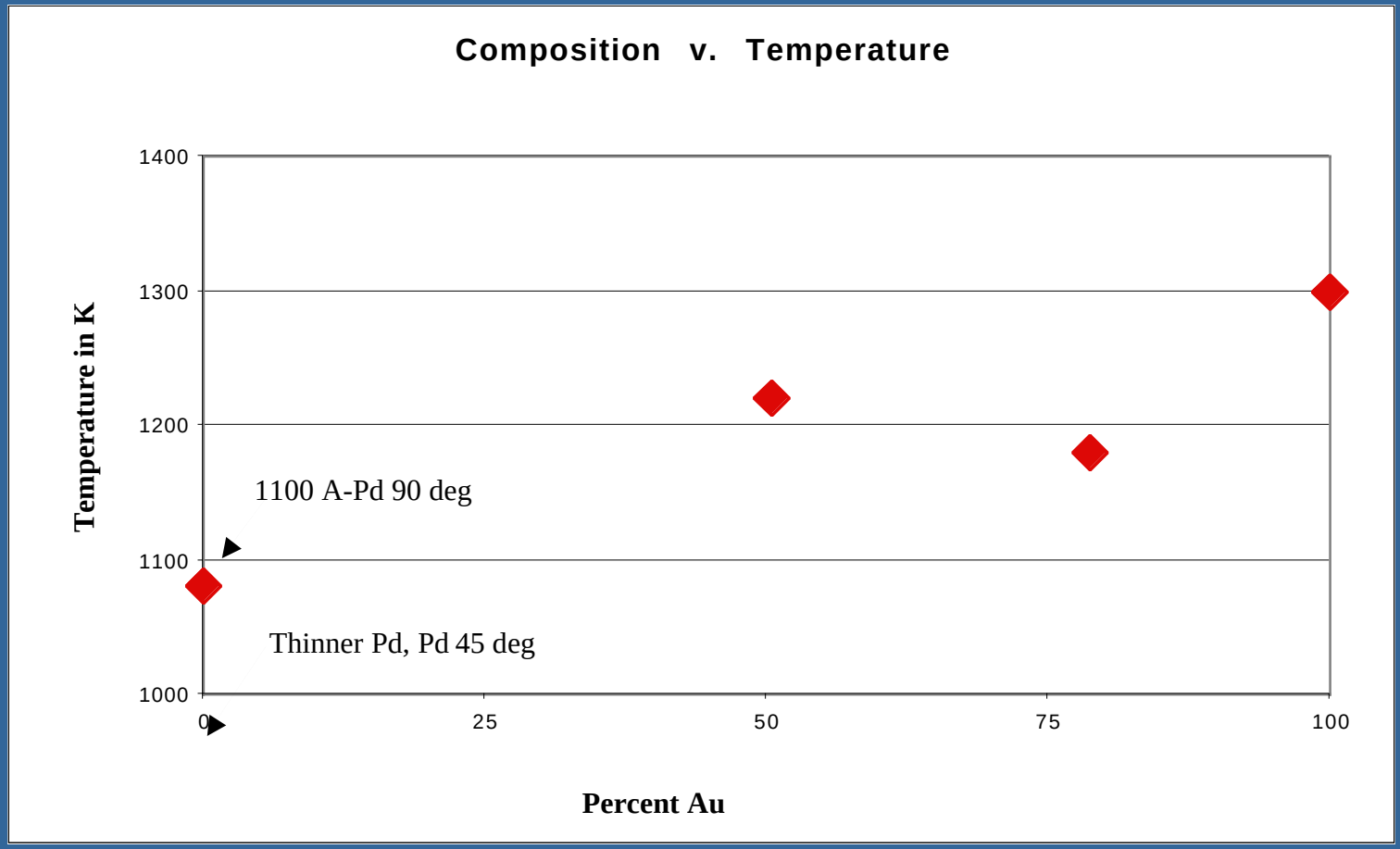


Degrees refer to angle of sputtering

Target survives higher temperatures when Au is added to Pd coatings

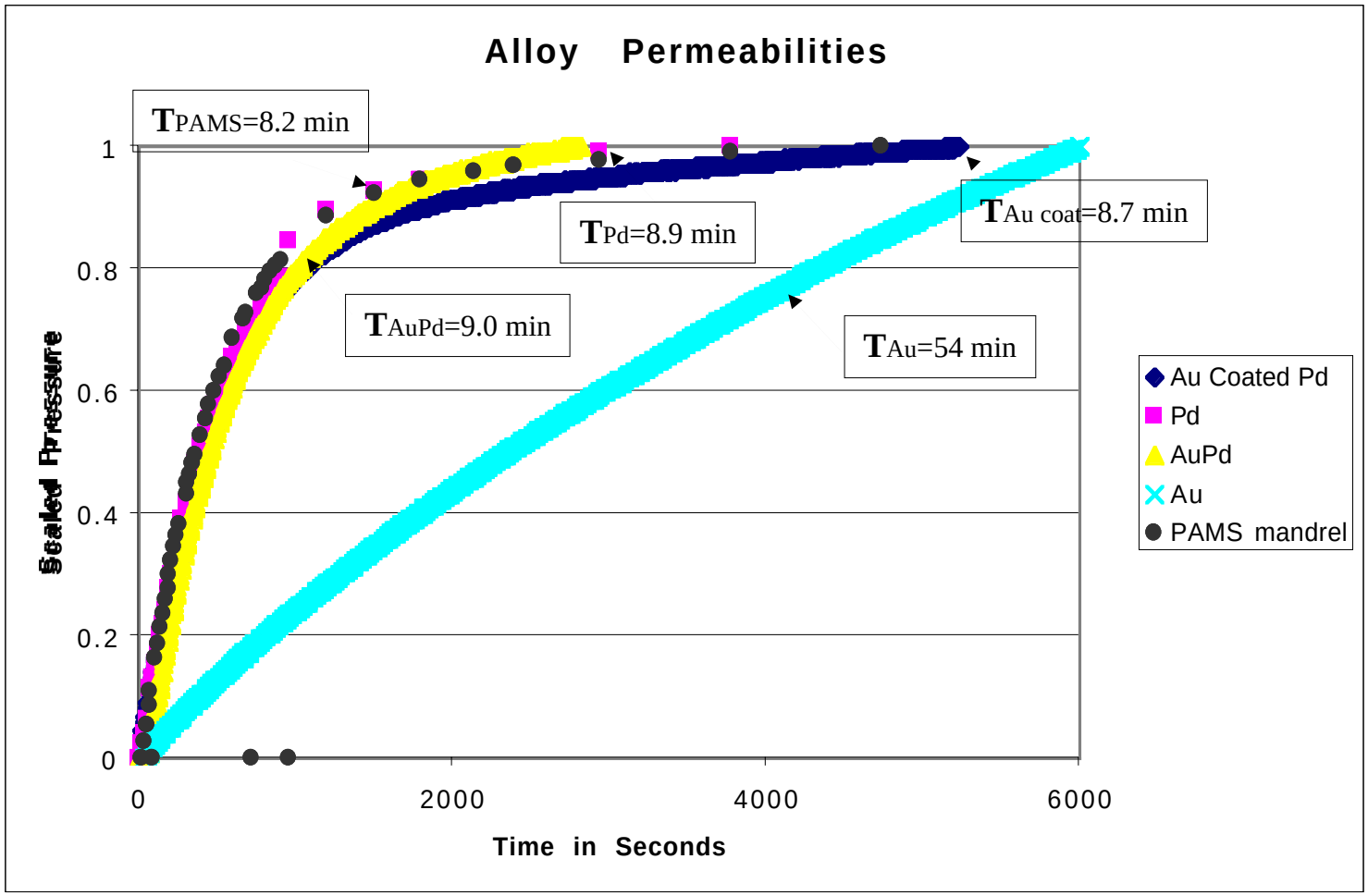


Reflectivity does not solely depend on composition …



… deposition conditions can have a significant effect

Permeability of Au-Pd shells were similar to palladium coated shells



Preliminary conclusions

- Pd coatings were more permeable than Au coatings but less reflective
- Addition of Au to Pd coatings increased coating reflectivity
- Certain deposition conditions yield better results: target survival at higher temperatures

In the Future

Short Term Goals

- Modify angle of co-sputtering to improve reflectivity.
- Calculate chamber temperature using reflectivity over all angles.
- Minimize surface defects.

Long Term Goals

- Measure reflectivity of shells.
- Examine coating foam shells
- Measure reflectivity in cryogenic conditions.
- Measure permeability at different temperatures to determine optimum filling conditions.