



Extrusion Reflectance Measurements

Chuck Bower, Stu Mufson, Amy Waldron

Indiana University

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Systematic Errors



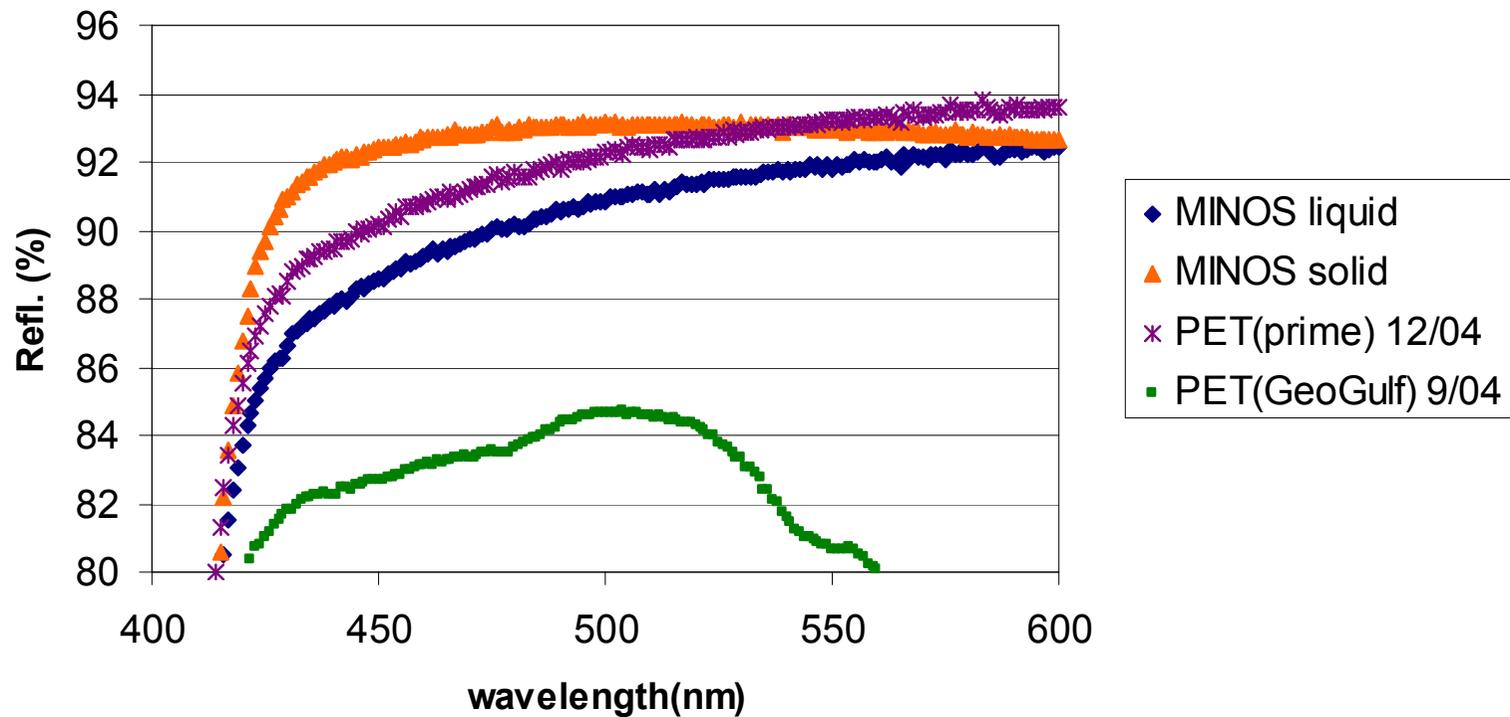
- Spectrophotometer results are **relative** measurements
 - “standard” mixed according to NIST formulation → systematic error $\sim 0.5\%$ in **absolute** results
 - Old standards are dirty
- Specimen must lie flat (2% errors seen; could be worse)
- Different locations on same sample can have different reflectances $\sim 0.5\%$ – (“repeatability”) in **relative** measurements
- ??



Measurements from this week



**Absolute Total (specular + diffuse) Reflectance
assuming halon reference standard is 99%
Systematic error ~1%**





Sanity Check



- Spectrophotometer has two reflectance modes: diffuse and total (diffuse + specular)
 - Three key materials were measured with both methods
 - > MINOS liquid prototype and MINOS solid production obeyed $R_{\text{tot}} - R_{\text{diff}} = 1\%$ above ~ 400 nm.
 - > Latest NOvA extrusion “PET(prime)” run showed $R_{\text{tot}} - R_{\text{diff}} = 0$.
 - Is this real??



Are we sure...?



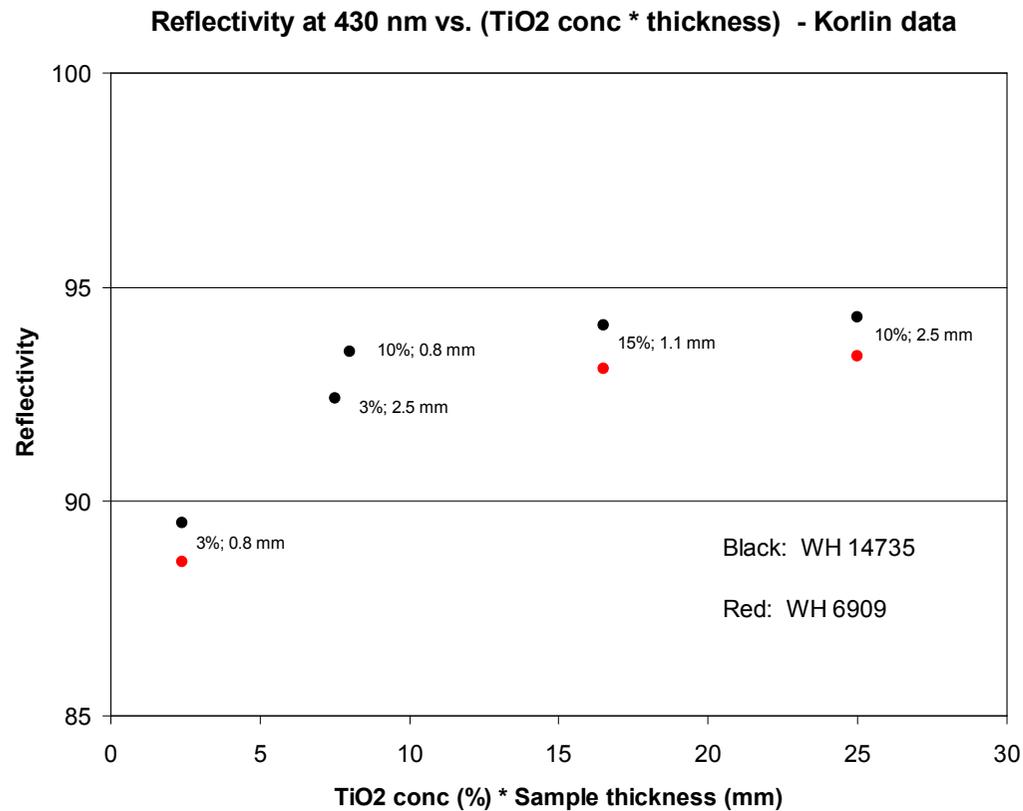
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- Is TiO_2 the right diffuse reflector component for NOvA extrusions?
 - Is PVC the right plastic base for the NOvA extrusions?
 - Cost is a (“the key”?) driver.
 - Strength of finished extrusion is a driver.



Ruddick Relation



- Reflectivity is a function of product of material thickness and diffuse reflector (powder) concentration

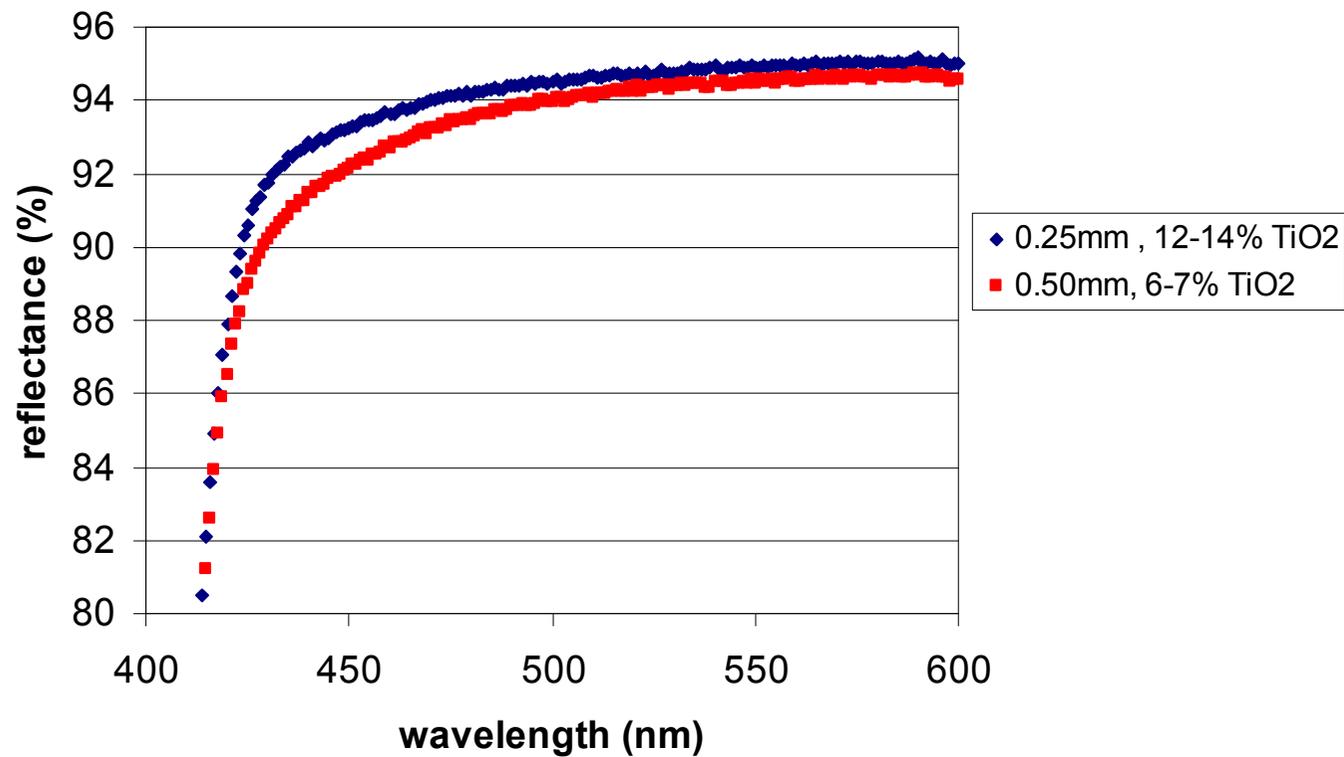




Ruddick Relation (new data)



Ruddick Product Effect -- Absolute total reflectance assuming halon standard of 99% WH1120S (from ~1998, Ruddick)





Summary



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- WARNING: Systematic errors can be large
 - Estimates of current technique ~1% (0.5% relative and 0.5% absolute)
 - Some past measurements were probably worse
 - Latest extrusion [PET(prime) run of 12/04] way better than previous NOvA prototype [PET(Georgia-Gulf) of 9/04]
 - Also ~1.5% better than MINOS liquid (commercial) extrusion
 - Are we using the right materials?
 - (Ruddick result:) Reflectance is a function of product of material thickness and TiO_2 concentration