Resist Outgas Discussion

- **Near Term –**

  Screen Resists for Alpha/Beta tools

  - **Counting Outgas Molecules/Rate**
  - **Witness Plate Test**

- **Longer Term –**

  Is resist outgas testing needed ?

  If so, how, and what levels for HVM ?

- **Near Term Focus –**

  Screen Resists for Alpha/Beta tools

  - **Counting Outgas Molecules/Rate**
    - **Methods in place or under development at multiple sites**
      - **Total pressure rise:**
      - SELETE, NIST, SEMATECH/ Albany Univ., Hanyang Univ., …
      - **Mass Spectroscopy:**
      - ALBANY Univ.

DISCUSSION:

Are we ok ?

Discussion

- Question for Nikon: Is mass spectrum required or is total pressure rise sufficient? – Answer: Mass spectrum is required to confirm components and total pressure rise can be used to count molecules.
- If specification is on hydro carbons, how can total pressure rise be correlated to the specification, since all molecules are counted? – Answer: Just assume everything is hydro carbon.

- **Near Term Focus –**

  Screen Resists for Alpha/Beta tools

  - **Witness Plate Test**
    - **Problems implementing at Albany, IMEC**
    - **TNO gearing up**
    - **No examples of failed resist yet? Will resist ever fail?**

DISCUSSION:

ASML/Intel/SEMATECH/others – establish fail point ?

Correlate alternative testing (total pressure rise) to Witness tests

Discussion

- Question: Where are guidelines to witness plate testing available? – Available on www.ieuvi.org → "TWG" → "Optics contamination and lifetime"
- Comment: Reflectivity measures crucial variable, only molecules/cm2 (total pressure rise method) does not take into account which molecules contaminate.
- Questions to ASML witness plate testing: What is the appropriate power level? – Answer: > 1mW/cm2 with higher power levels okay, but NO rescaling reasonable.
- Comment: At end of 2007, TNO will be ready for resist outgassing testing.
- Comment: Negative result should be observed on TNO test.
- Comment: To obtain a negative result on the TNO/ASML test, the first step should be to develop a resist that outgases a lot, whereas the resist should be similar to an EUV resist (important is not only outgassing, but WHAT outgases, e.g. use resist with high PAG loading).
- Question to TNO: Which outgassing products are a problem? – Answer: TNO can not comment.
- Comment: To obtain a negative result, high PAG loading is one option, however, high dose is required (not scale to E0).
- Question to be investigated: How does outgassing rate change with power density?
- Question: Why not take PMMA (for negative result on TNO test)? – Answer: Relevant resist and relevant does should be used.
- Question: Can data, i.e. a negative result, be obtained by SPIE conference spring 2008? – Answer: That is the intent. (SEMATECH is driving the testing.)
- Comment: Is there an alternative (cheaper and faster) test, that could be correlated to witness plate testing?

- **Longer Term Focus –**

Is resist outgas testing needed ?

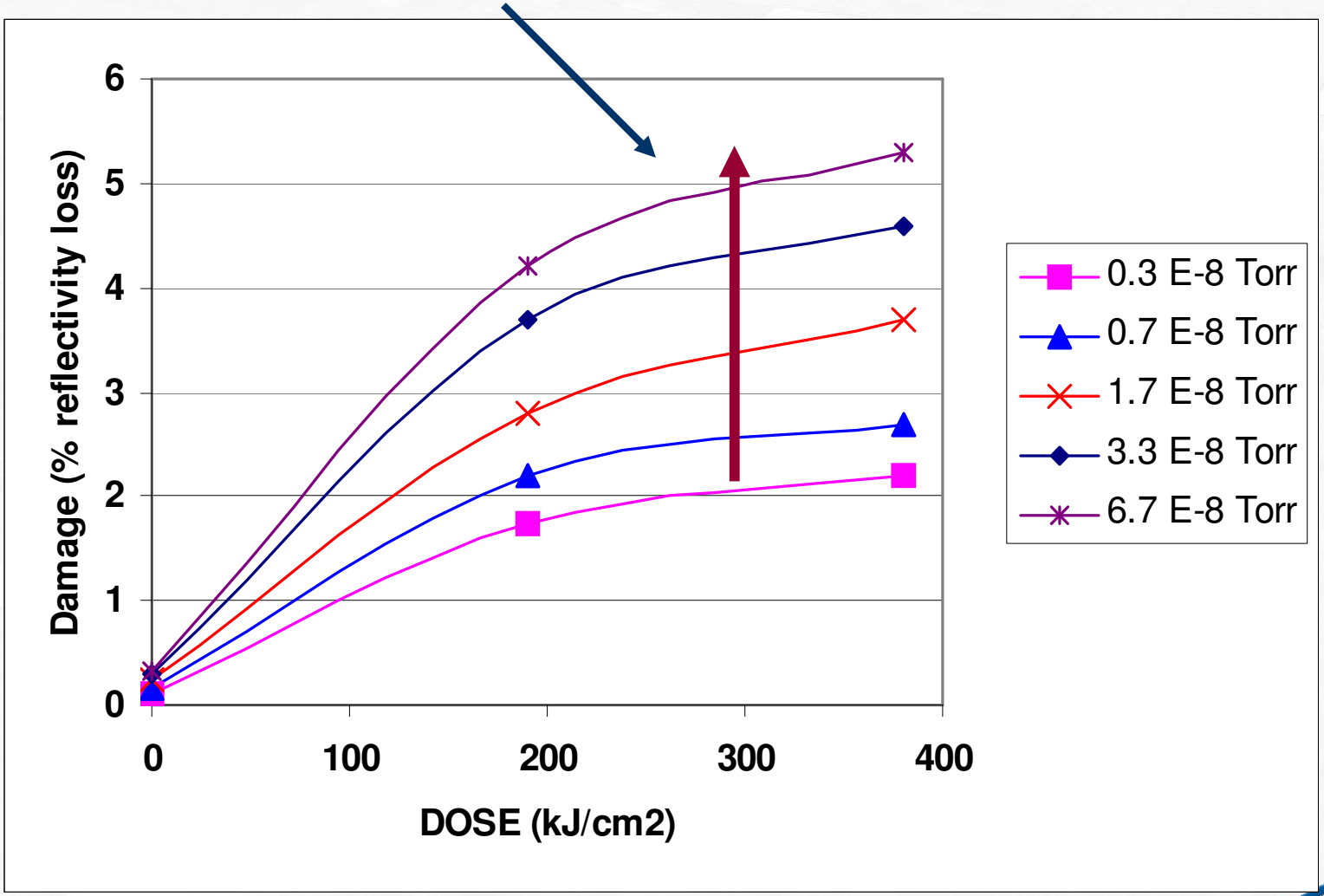
If so, how, and what levels for HVM ?

Discussion

- Comment: Extrapolating from alpha tool results to pre-production tools is not advisable.
- Comment: Results with continuous wave radiation are non-linear in pressure and dose.
- Comment: Non-linearity depends on contamination type (carbonization vs. oxidation).
- Comment: Until more is known, it is difficult to predict what occurs under HVM conditions.
- Comment: Cycle time (and cost) of ASML/TNO test is a concern to materials/resist suppliers.
- Question to TNO: With MET-2D approved and RGA data available, could other resists be correlated? – TNO Answer: No, RGAs do not capture everything, especially HC with mass > 200 amu.
- Comment: Very little molecules with mass > 200 amu observed.

NIST studies accelerated testing (courtesy Shannon Hill)

20x increase partial pressure → only 2.5x increase damage



Damage rate not linear with dose ?

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