Novel Lifecycle Monitoring Method for Exposed Aircraft Coatings

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Agenda

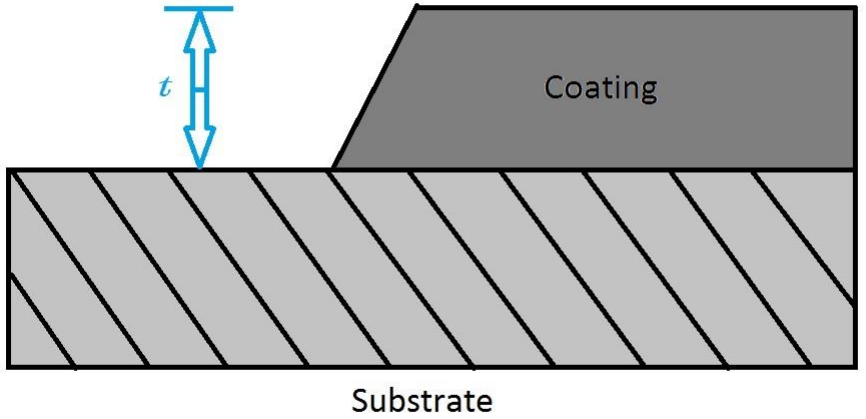
- Significance
- Coating Thickness Implications
- Micro-Ball Testing
- Alternative Methods
- Ball Crater Implications
- Questions

Significance – Aircraft Coatings

- General issues aircrafts face:
  - Erosion of outer surfaces
  - Mechanical and electrical complications
- Coatings of outer surfaces
  - Integrity of aircraft
  - Capital investments

Significance – Coating Thickness

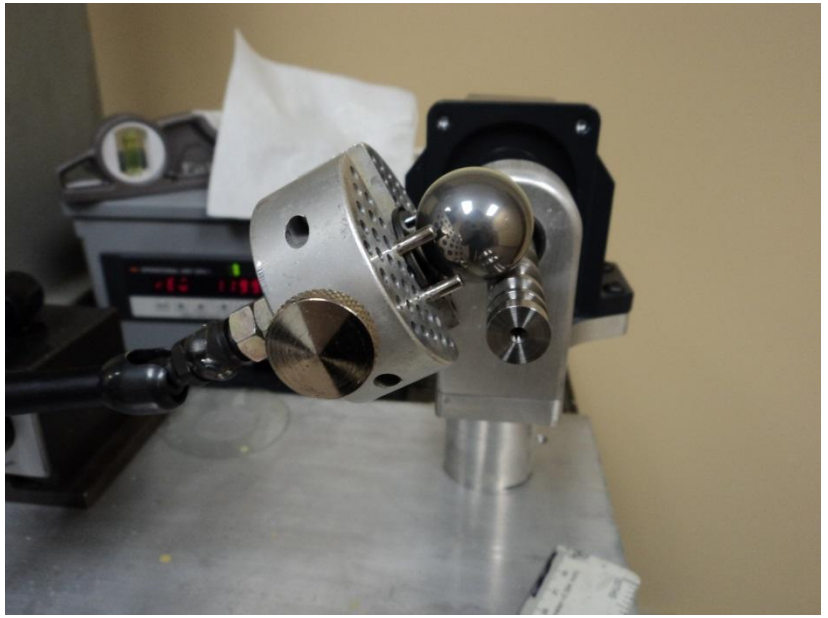
- Aid in data comparison:
  - Substrates
  - Hardness
  - Failed parts
  - Proper layers
  - Lifecycle monitor, etc.



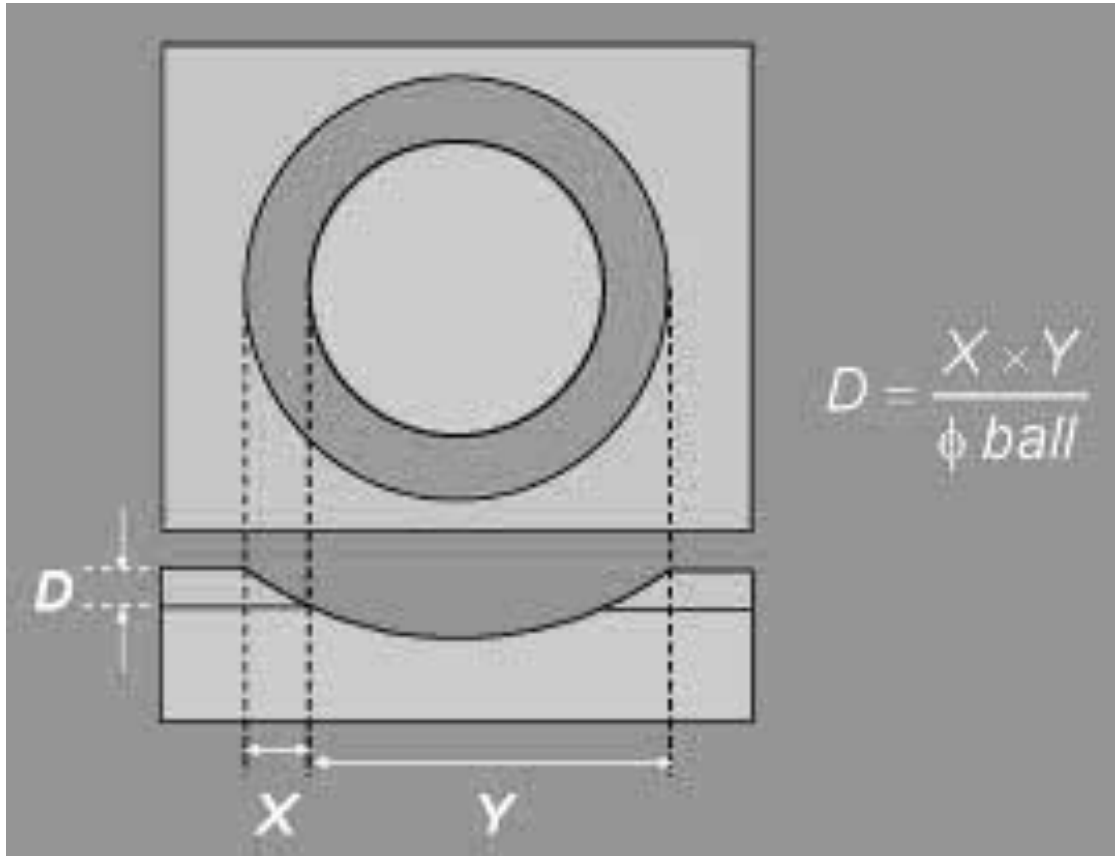
- Increased efficiency and applications

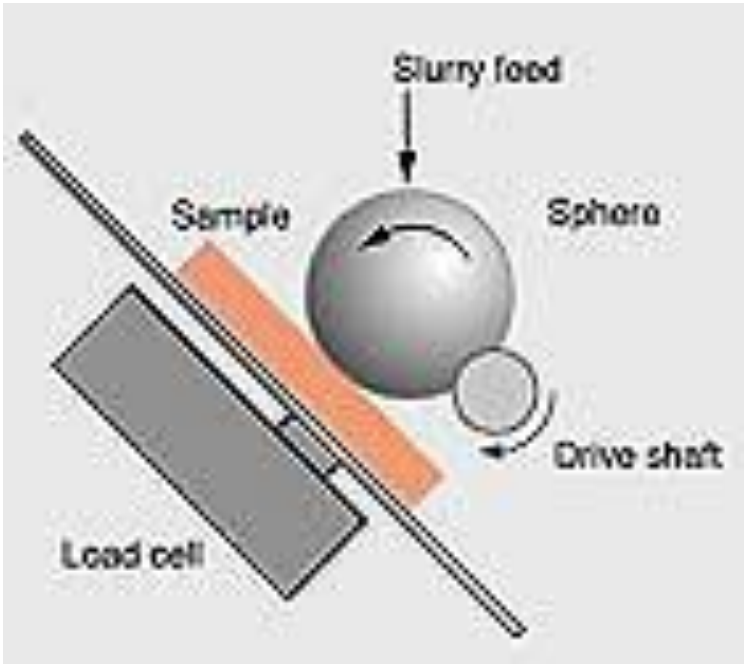
Significance – Ball Crater Test Method

- Method:
  - Rotating sphere of know diameter pressed onto coated component
  - Applied slurry – diamond or silica; crater abraded
  - Wear diameters measured with optical microscope; thickness calculated
- Usage
  - Thin Filmed Coatings
  - UPT made Calotester

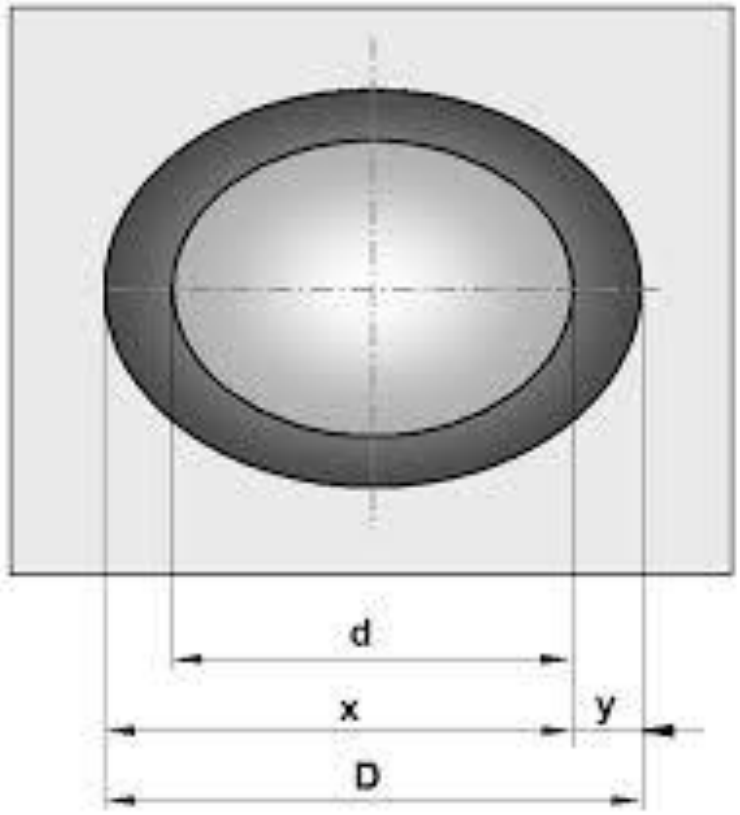


Thickness Determination





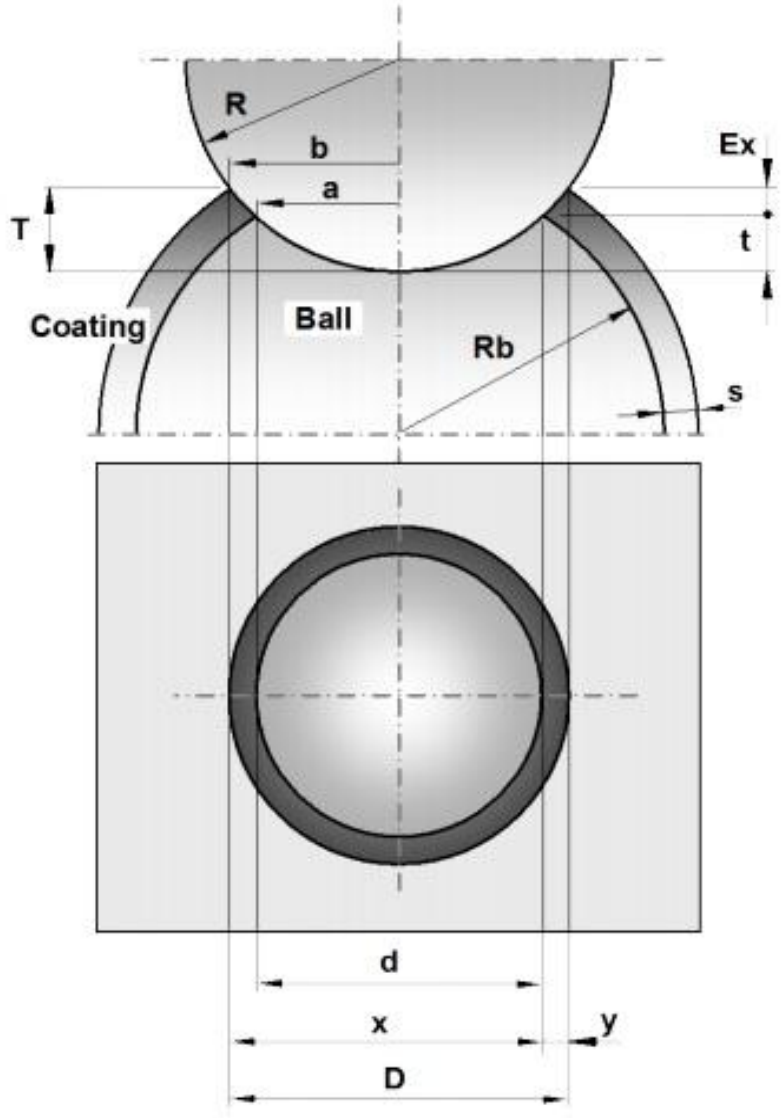
Ball – Cylinder Model



$$s = \frac{D^2 - d^2}{8R}$$

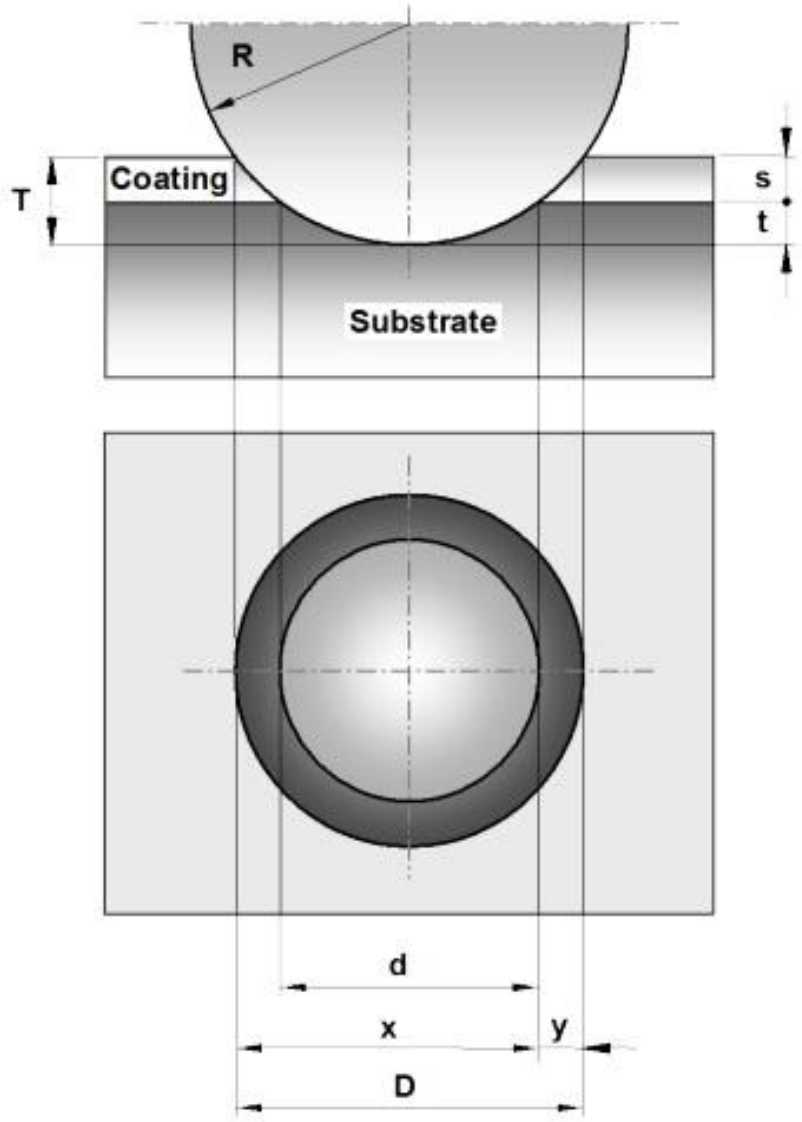
$$s = \frac{xy}{2R}$$

Ball – Ball Model



$$S = \frac{xy}{2}\left(\frac{1}{Rb} + \frac{1}{R}\right)$$

Ball – Plane Model

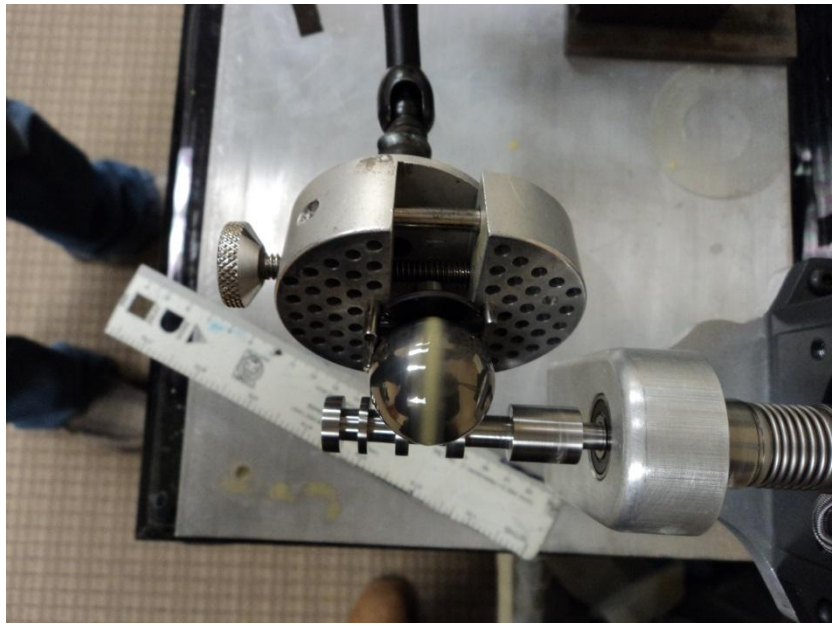


$$s = \frac{1}{2}\left(\sqrt{4R^2 - d^2} - \sqrt{4R^2 - D^2}\right)$$

$$s = \frac{xy}{2R}$$

Implications – Challenges

- Errors
  - Setup
  - Failed tests
- Time
- Measurement Software
  - Separate from tester



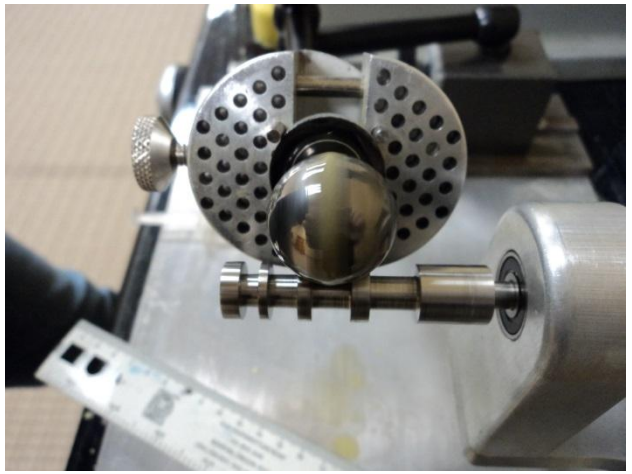
Alternate Methods

- Elcometer
  - Nondestructive
  - Rely on software

- Elipsometer
  - Nondestructive
  - Wavelength technology

Implications – Ball Crater Benefits

- Lower capital investment
- Minimal coating deterioration
- Proven accurate measurements and calculations
- Direct measurements
  - Immediate knowledge of a failed test
- Data acquisition
- Imaging



Questions