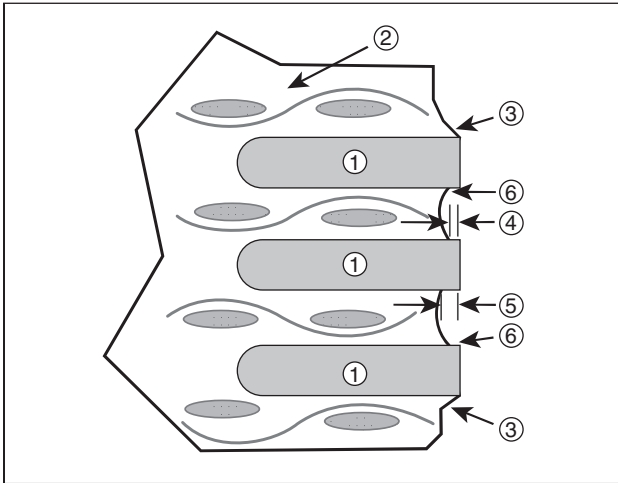


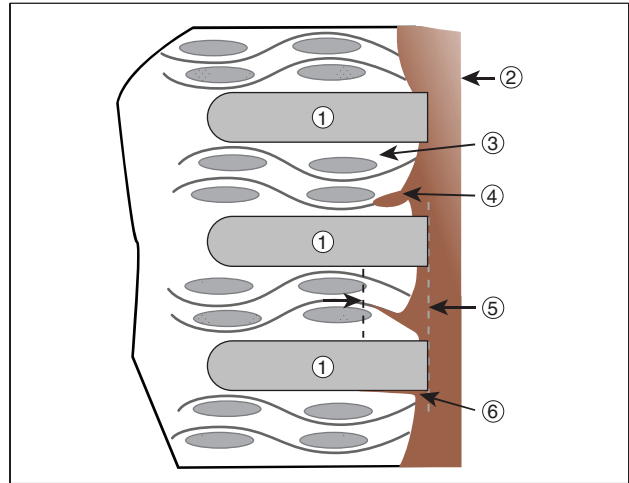
### 3.1 DIELECTRIC MATERIALS

#### 3.1.6 Dielectric Removal (cont.)



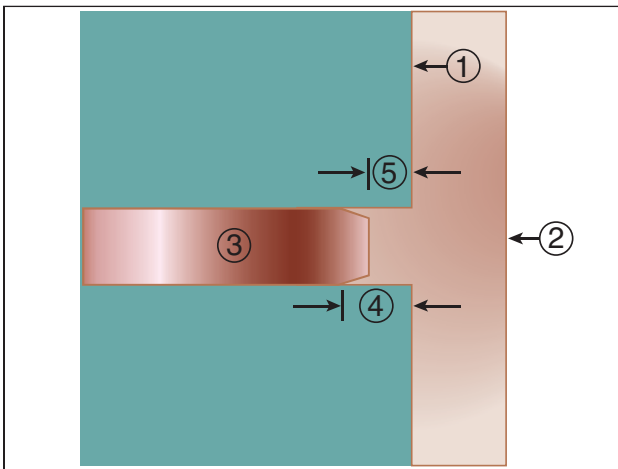
**Figure 316b Measurement for Etchback**

- Note 1:** Internal conductor.
- Note 2:** Dielectric (resin and/or glass fiber).
- Note 3:** Shadowing is permitted on one side of each land.
- Note 4:** Positive etchback measurement (minimum).
- Note 5:** Positive etchback measurement (maximum).
- Note 6:** The etchback **shall** be effective on at least the top or bottom surface of each internal conductor.



**Figure 316c Measurement for Dielectric Removal**

- Note 1:** Internal conductor.
- Note 2:** Copper plating.
- Note 3:** Dielectric (resin and/or glass fiber).
- Note 4:** Example of drill gouge or random "tear outs."
- Note 5:** Dielectric removal: Combined wicking allowance plus etchback or smear removal allowance (maximum) is measured from the drilled edge of the foil.
- Note 6:** Dielectric removal along the inner layer foil combined with copper penetration resulting from combined allowances for wicking plus etchback or smear removal allowance (maximum) as measured from the drilled edge of the foil.



**Figure 316d Measurement for Negative Etchback**

- Note 1:** Drilled hole wall.
- Note 2:** Copper plating.
- Note 3:** Internal land.
- Note 4:** Distance "Z" depicts the least amount (20-30% of the total thickness) of etched internal copper foil.
- Note 5:** Distance "X" depicts the most prevalent amount (70-80% of the total thickness) of etched internal copper foil.

Visual observations made on cross-sections only.

## 3.1 DIELECTRIC MATERIALS

### 3.1.6.1 Etchback

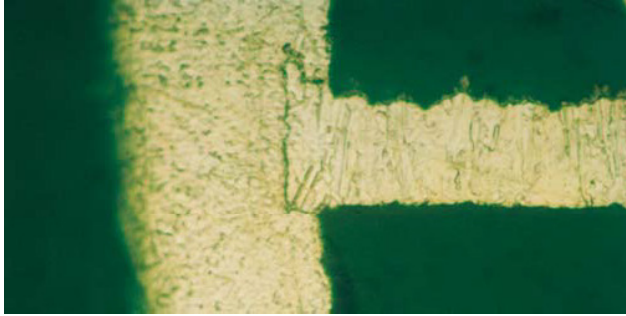


Figure 3161a

#### Target Condition – Class 1, 2, 3

- Uniform etchback to a preferred depth of 13  $\mu\text{m}$  [512  $\mu\text{in}$ ].

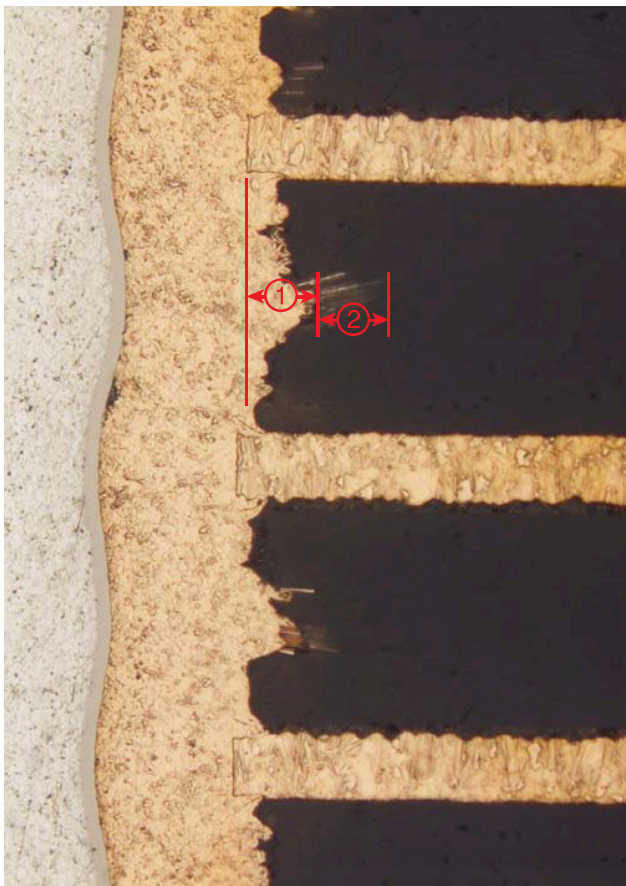


Figure 3161b

**Note 1:** Etchback measurement.

**Note 2:** Wicking measurement.

#### Acceptable – Class 1, 2, 3

- Etchback between 5  $\mu\text{m}$  [197  $\mu\text{in}$ ] and 80  $\mu\text{m}$  [3,150  $\mu\text{in}$ ].
- The combination of dielectric removal from etchback plus wicking allowance (wicking and random tears or drill gouges resulting from hole formation and/or hole cleaning) does not exceed the sum of the maximum allowable etchback removal and the maximum allowable wicking limits of 3.3.4. In no case can the individual maximum conditions of wicking or etchback be exceeded.
- Shadowing is permitted on one side only of each land.

Visual observations made on cross-sections only.

### 3.1 DIELECTRIC MATERIALS

#### 3.1.6.1 Etchback (cont.)

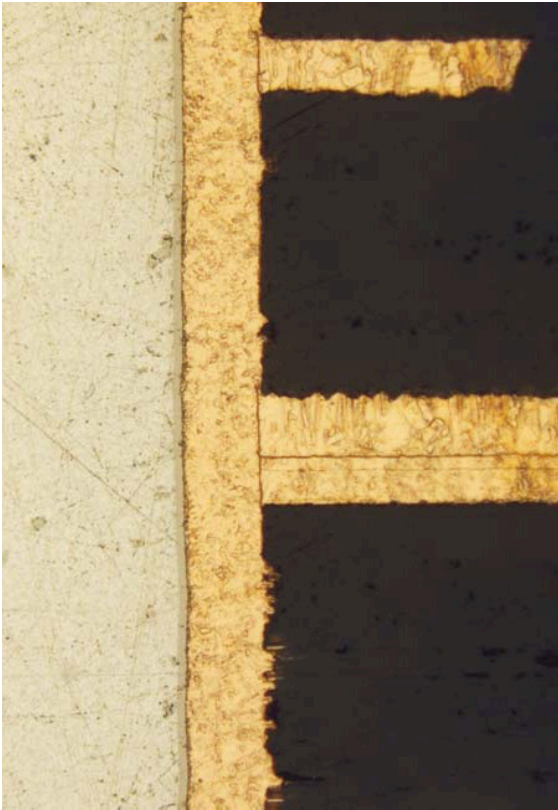


Figure 3161c



Figure 3161d

#### Nonconforming – Class 1, 2, 3

- Observed conditions either do not meet or exceed above criteria.

Visual observations made on cross-sections only.

## 3.1 DIELECTRIC MATERIALS

### 3.1.6.2 Smear Removal

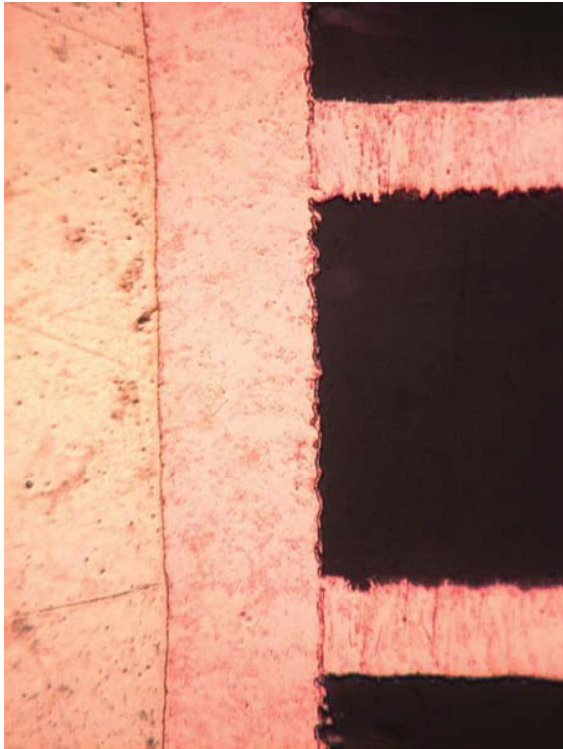


Figure 3162a

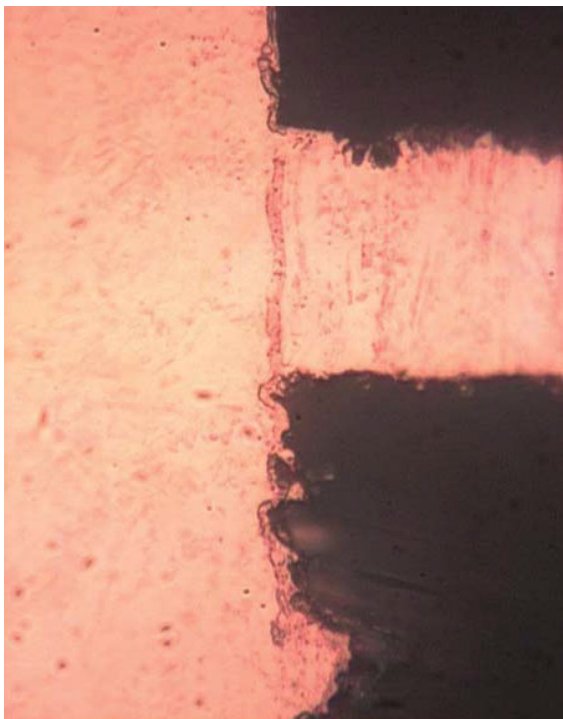


Figure 3162b

#### Acceptable – Class 1, 2, 3

- Smear removal has not been etched back greater than 25  $\mu\text{m}$  [984  $\mu\text{in}$ ].
- The combination of smear removal, drill gouges, random tears and hole formation do not exceed the sum of the maximum allowable smear removal and the maximum allowable wicking limits of 3.3.4.
- Smear removal sufficiently meets the acceptability criteria for inner-layer plating separation (3.3.6).

Visual observations made on cross-sections only.

### 3.1 DIELECTRIC MATERIALS

#### 3.1.6.2 Smear Removal (cont.)



Figure 3162c

#### Nonconforming – Class 1, 2, 3

- Observed conditions either do not meet or exceed above criteria.



Figure 3162d

Visual observations made on cross-sections only.

## 3.1 DIELECTRIC MATERIALS

### 3.1.6.3 Negative Etchback

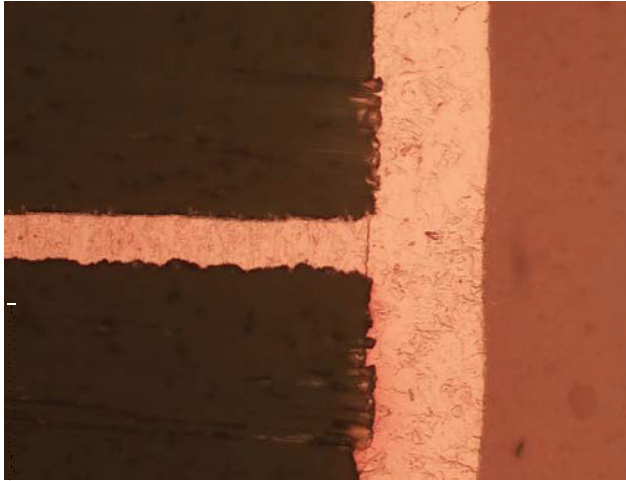


Figure 3163a

#### Target Condition – Class 1, 2, 3

- Uniform negative etchback of copper foil not exceeding  $2.5\ \mu\text{m}$  [ $98.4\ \mu\text{in}$ ].

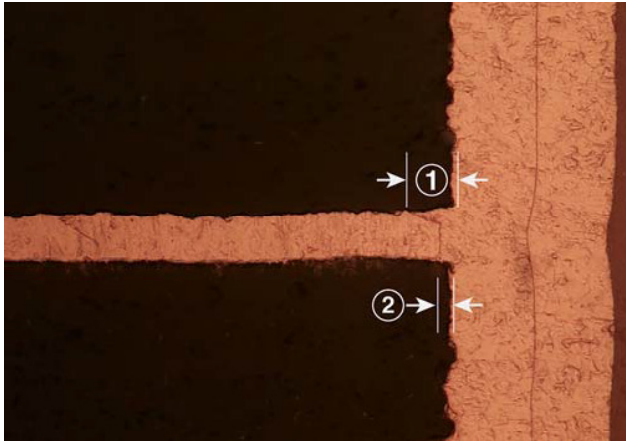


Figure 3163b

Note 1: Distance "Z"

Note 2: Distance "X"

#### Acceptable – Class 3

- Negative etchback less than  $13\ \mu\text{m}$  [ $512\ \mu\text{in}$ ] for distance "X."
- Negative etchback less than  $19.5\ \mu\text{m}$  [ $768\ \mu\text{in}$ ] for distance "Z."

#### Acceptable – Class 1, 2

- Negative etchback less than  $25\ \mu\text{m}$  [ $984\ \mu\text{in}$ ] for distance "X."
- Negative etchback less than  $37.5\ \mu\text{m}$  [ $1,476\ \mu\text{in}$ ] for distance "Z."

Visual observations made on cross-sections only.

## 3.1 DIELECTRIC MATERIALS

### 3.1.6.3 Negative Etchback (cont.)

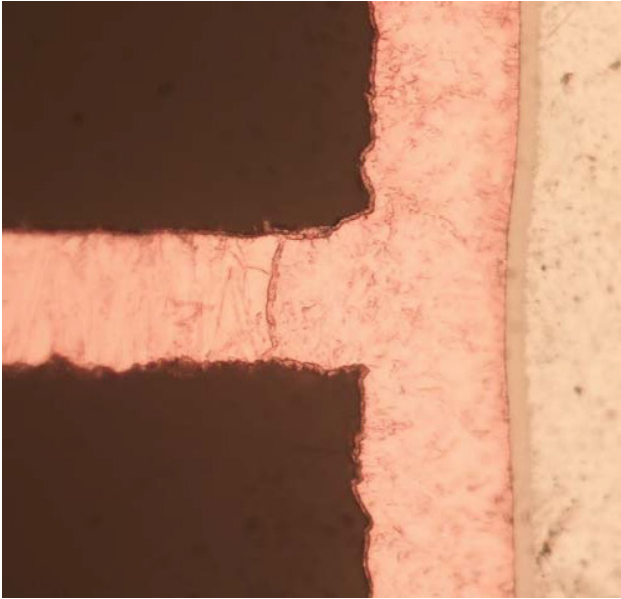


Figure 3163c

#### Nonconforming – Class 1, 2, 3

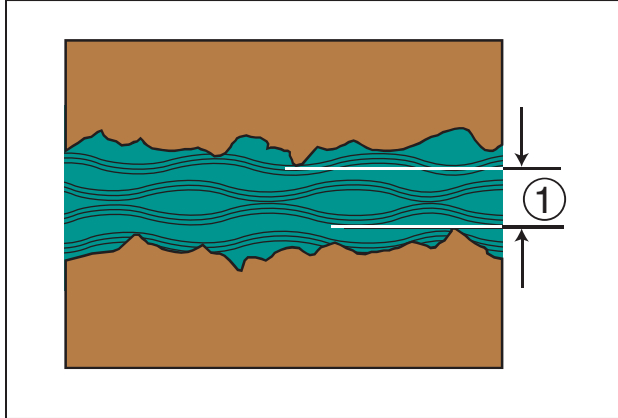
- Observed conditions either do not meet or exceed above criteria.

Visual observations made on cross-sections only.

## 3.1 DIELECTRIC MATERIALS

### 3.1.7 Layer-to-Layer Spacing

Minimum dielectric thickness is the maximum material condition used for the electrical voltage dielectric strength requirements.

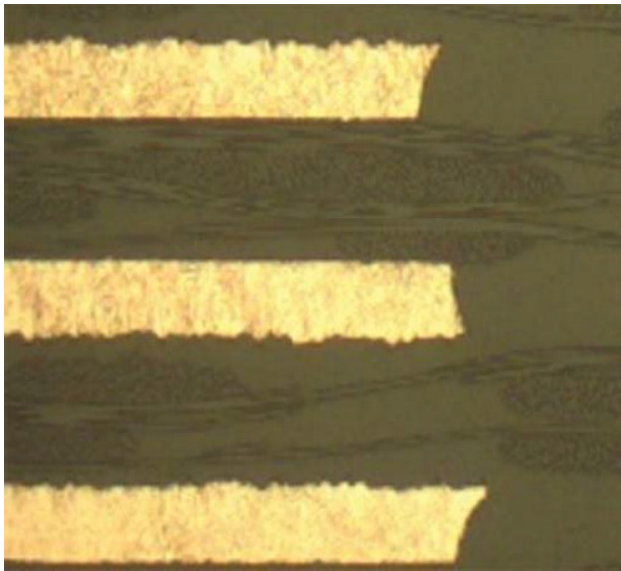


**Figure 317a Measurement of Minimum Dielectric Spacing**

**Note 1:** Minimum Dielectric Spacing

#### **Target Condition – Class 1, 2, 3**

- The minimum dielectric thickness meets the requirements of the procurement documentation.

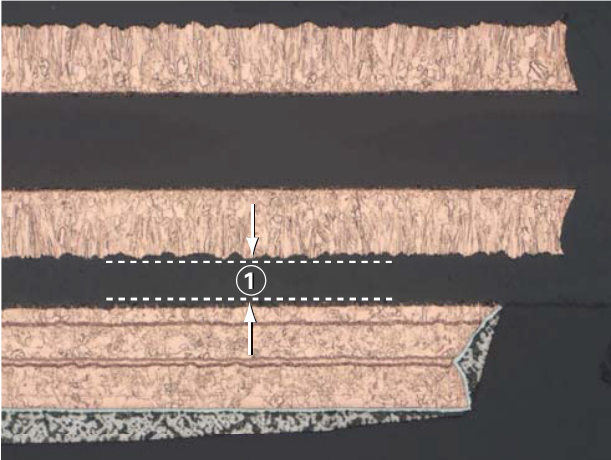


**Figure 317b**

Visual observations made on cross-sections only.

## 3.1 DIELECTRIC MATERIALS

### 3.1.7 Layer-to-Layer Spacing (cont.)



**Figure 317c**

**Note 1:** Minimum Dielectric Spacing

#### Acceptable – Class 1, 2, 3

- The minimum dielectric thickness meets the minimum requirements of the procurement documentation.
- When the minimum dielectric spacing and/or the number of reinforcing layers are not specified, the dielectric spacing is  $\geq 0.09$  mm [0.0035 in] and the number of reinforcing layers are selected by the supplier. For nominal spacings  $< 0.09$  mm [0.0035 in], see Notes 2 and 3 below.
- Low profile copper foils should be used with dielectrics below 0.09 mm [0.0035 in].

#### Nonconforming – Class 1, 2, 3

- Observed conditions either do not meet or exceed above criteria.

#### Notes:

- 1: Products designed for transmission line impedance applications may have special requirements and measurement method specified on procurement documentation.
- 2: When the nominal dielectric thickness on the drawing is less than 90  $\mu\text{m}$  [3,543  $\mu\text{in}$ ], the minimum dielectric spacing is 25  $\mu\text{m}$  [984  $\mu\text{in}$ ] and the number of reinforcing layers may be selected by the supplier.
- 3: Core layers of 25  $\mu\text{m}$  [984  $\mu\text{in}$ ] nominal or less dielectric spacing are excluded from the above requirement.

Visual observations made on cross-sections only.

## 3.1 DIELECTRIC MATERIALS

### 3.1.8 Resin Recession

**Resin Recession:** A separation between the plated barrel of the hole and the dielectric material on the hole wall.

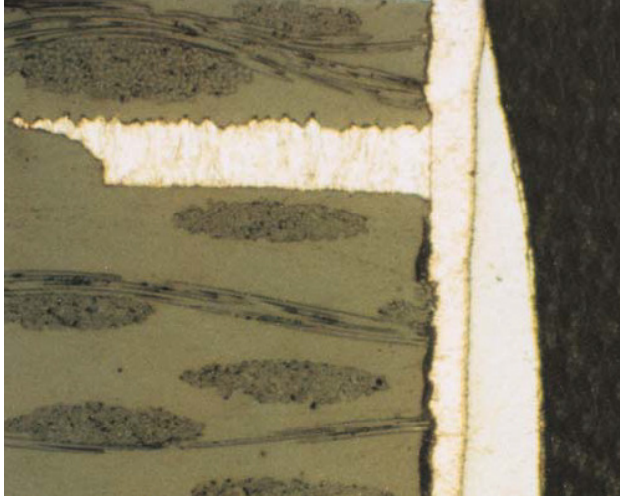


Figure 318a

#### Acceptable – Class 1, 2, 3

- Resin recession is acceptable following thermal stress testing.

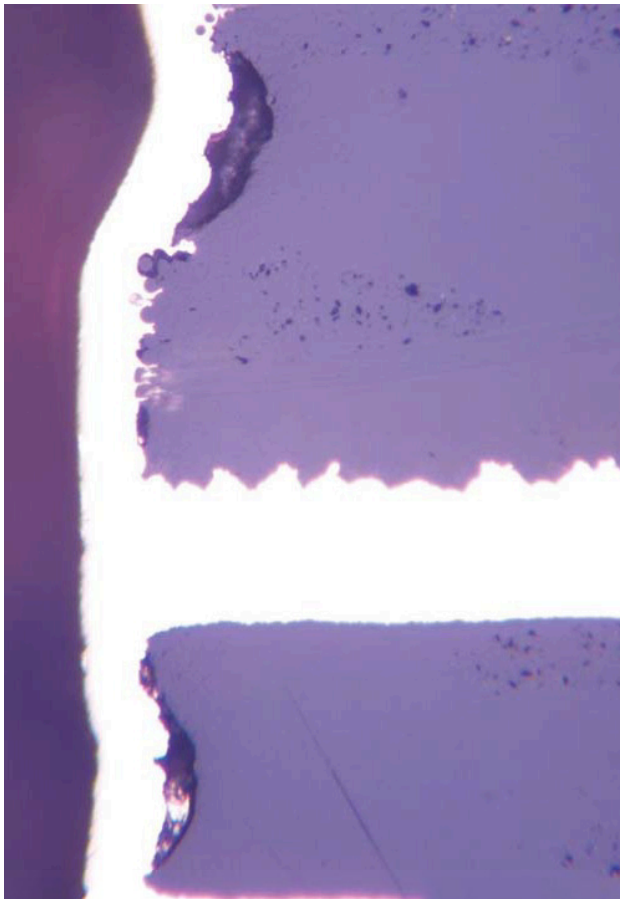


Figure 318b

Visual observations made on cross-sections only.