SITVs Stack-ups and Loss

SITV Stack-ups General

- **Signal Integrity TVs are often used to characterize material performance**
- **There are a variety of TVs that use differing approaches and measurement methods**
- **Many users now are trying to specify the resin content (RC) range and match both sides of a stripline**
  - This issue is the main point of this presentation

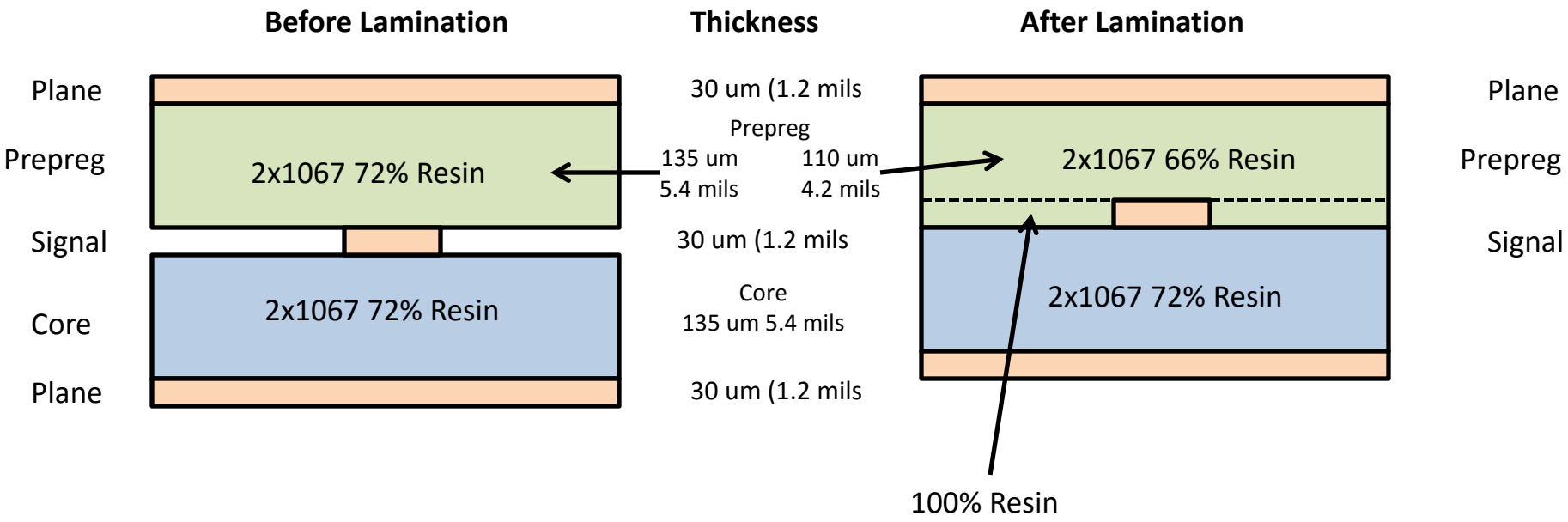
Loss Characterization

- **Generally, the following is accepted**
  - Wide traces are better
  - Core is more consistent and foil roughness towards the core is known
- **Prepreg side is difficult to fully control**
  - Cure may vary, resin content varies, oxide surface may vary
- **Thin prepreg openings compared to core thickness do not perform as well as balanced or core thinner constructions**

Balancing Resin Content

- **The main misunderstanding on SITVs is this:**
  - The core RC is tightly controlled and does not change once core is built
  - The prepreg resin has to flow into the space around the etched transmission lines
    - This reduces the resin content of the prepreg above the transmission line
  - Many SITVs are specified with starting RC values, not finishing RC values.
- **Starting with prepreg and cores having the same RC value and same glass style will not result in the intended result**

Example Target 70-75% Resin



During lamination, the prepreg melts and flows into the areas around copper etched feature. In most SITVs the copper area is very small, so the resin requirement to fill this space is about 90-95% of copper thickness.

This outflow of resin lowers the resin content of the prepreg layer, above the copper layer. The “effective resin content” in this case, is 66%, not 72%.

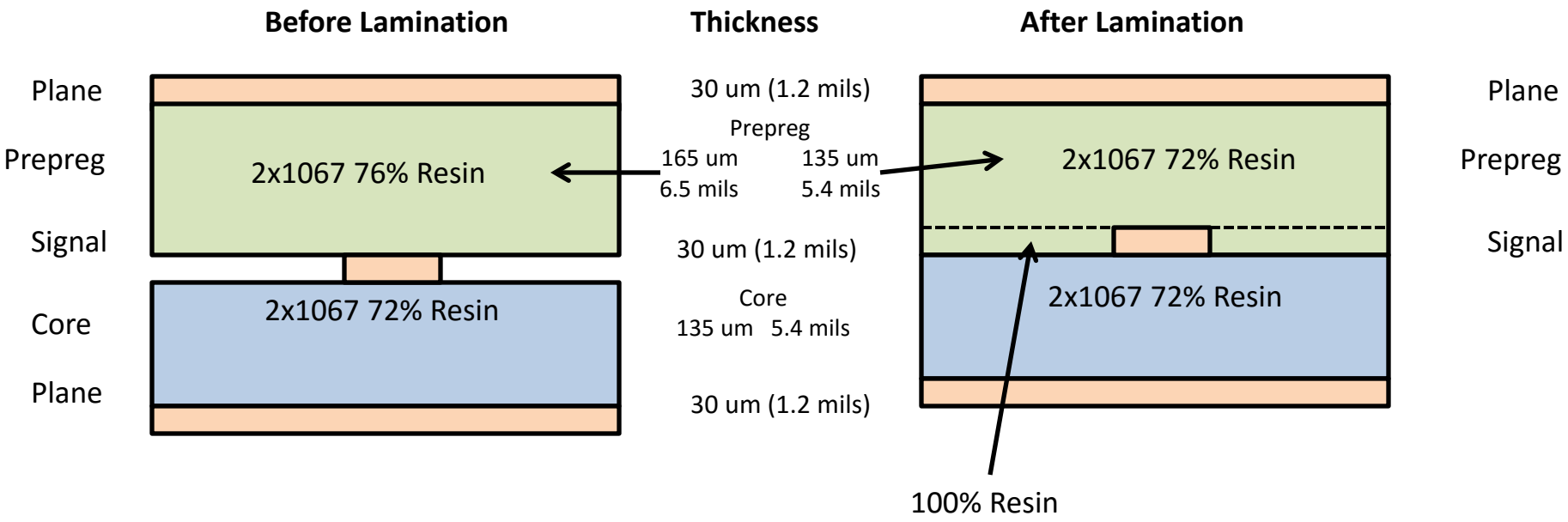
In example above the resin content is reduced about 6%

This results in higher dielectric constant, may change dielectric loss, creates high current density on the prepreg side of the etched circuit which usually gives higher loss values, and does not meet the 70% resin content requirement.

Making a Balanced TV

- **To make a balanced TV, you need a higher starting resin content on the prepreg layer**
- **In some cases, a different glass style on the prepreg layer may be needed to correctly match**
- **The basic rules are:**
  - If same glass style, the prepreg RC value needs to be chosen to result in the same thickness as the core.
  - If a different glass style is chosen, it needs to result in a prepreg thickness equal to or thicker than the core layer

Example Target 70-75% Resin Alternate



In this approach, the initial prepreg resin content is high, above the target, but after the resin loss into the circuit area, the structure is nearly balanced.

Note-This is an example, the 76% prepreg may not be feasible to make. This also helps to show how high resin content structures can be hard to make balanced.

Feasibility Resin Content

- **In some cases, particularly when high RC values are requested, it may not be feasible for a material system to create the needed prepreg**
  - There is a maximum amount of resin that can be coated onto glass layers. Beyond this amount the product is inconsistent and impractical to produce.
  - Different glass styles can accept differing maximum RC values.
    - Allowing glass style substitution can help in these cases
- **Most PCB fabricators have good thickness calculators. They may not have good RC calculators**
  - So specifying thickness helps if same glass style is being used

Summary

- **To obtain consistent and accurate SI material properties, the TV stack-up designs should:**
  - Clearly state that the Resin Content % is after lamination
    - This provides a more symmetrical stripline
  - Alternately, specify the prepreg thickness to be the same as the core
  - Allow mixed glass styles
    - It may not be feasible to match glass styles in the core and the prepreg.
    - If you have specific restrictions on some glass styles, this should be communicated.
  - Prepreg layers should be maintained at ≥ core thickness