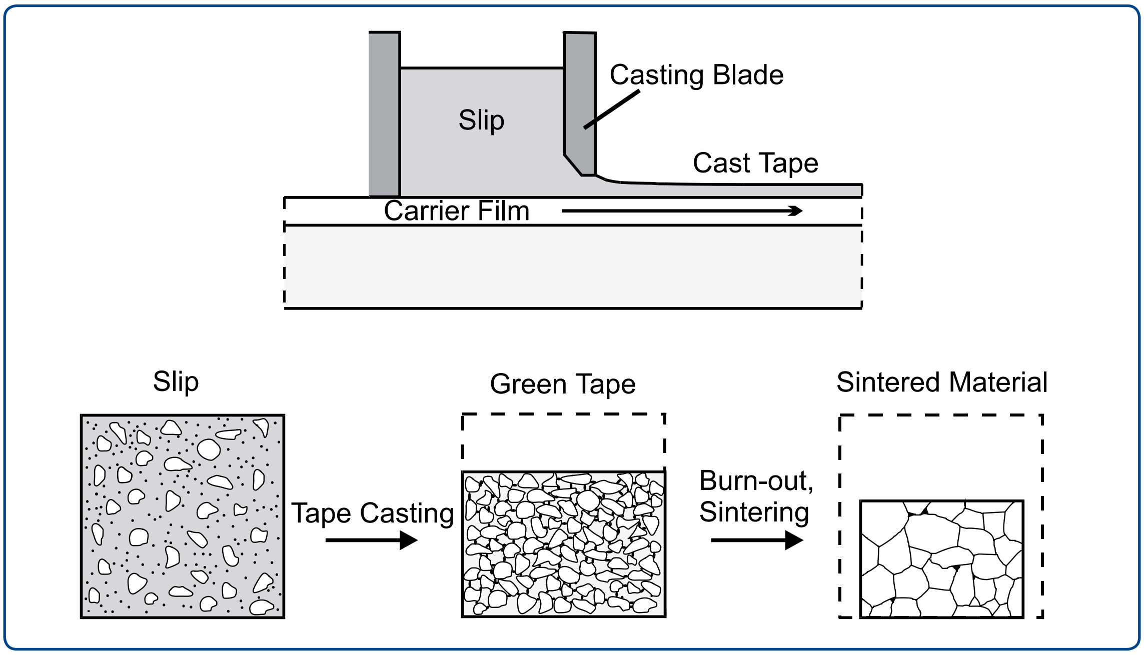
Tape Casting



The top schematic drawing illustrates tape casting. The bottom sketch shows the different stages during the processing: the slip consisting of water, ceramic particles and binder; the cast, dried green sheet; and, finally, the microstructure of the sintered material.

Tape casting is a forming technique for producing thin, flat ceramics. The method was originally developed for producing electronic ceramics (insulating substrates and packages and multilayer capacitors) and is still mainly used for this. Structural laminates, knives, membranes and solid oxide fuel cells are examples of other applications for thin ceramics formed by tape casting. The tape thickness that can be achieved is generally in the range of 25 µm up to 1 mm but it is possible to produce tapes down to 5 µm.

We have focused our research and development within this area on water-based tape casting. An aqueous system has the advantages of reducing health and environmental hazards coupled with lower cost and a more manageable process. Among the disadvantages of water-based tape casting we can mention slower drying, higher crack sensitivity and, for some ceramics, reactions with water. Studies have been made, in which the entire process chain has been evaluated with regard to rheological properties, drying, binder removal, sintering and, finally, microstructure. Acrylic latex-type binders have been identified as the best type of binder owing to their low viscosity at high polymeric content and their internal plasticization, which makes additional plasticizer superfluous. Furthermore, lamination is possible at room temperature. Green tapes are obtained that are insensitive to air humidity, at the same time as they have a high quality with regard to surface smoothness, flexibility and green density. The longer drying times of water-based systems are overcome by the fact that higher solids loading is possible in aqueous systems than in organic, solvent-based systems, coupled with effective heating during drying. Important characteristics of the latex relevant to the processing are the latex particle size, the stabilisation type of the latex and the type of polymer.

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Contact us for more information

Do not hesitate to contact us if you want to have more information or have specific questions that you want to discuss. Based on your requests and needs we can provide a quotation.

More information is provided by:

Johanna Stiernstedt, *johanna.stiernstedt@swerea.se*

Swerea IVF AB, +46 (0)31-706 60 00

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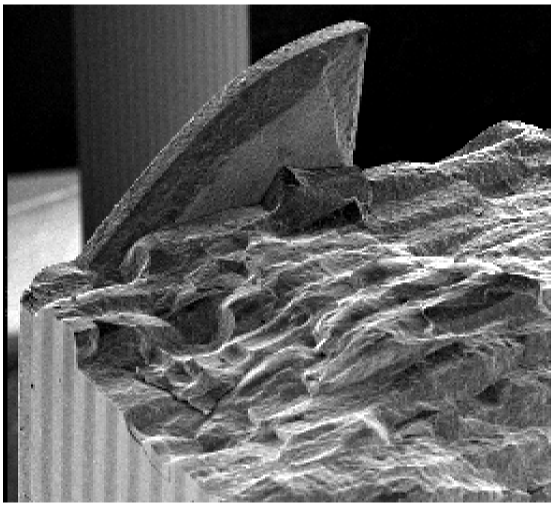

Fractured surface of an Al_2O_3, ZrO_2/Al_2O_3 laminate manufactured by tape casting. It has been demonstrated that certain types of laminates have an increased thermal shock resistance compared with the constituent layer materials.

Tape cast materials – examples:

Al_2O_3, ZrO_2, cordierite, mullite, aluminium titanate, PZT, SiC, Si_3N_4 and particulate composite materials: Al_2O_3-ZrO_2, cordierite-ZrO_2 and Si_3N_4-TiN. Laminated structures such as Al_2O_3 membranes, SiC/C laminates and PZT-actuators have been made of these materials.

The tape caster (TC 155 from AEM Inc.) is a continuous machine with a stationary casting head. The machine is designed for making thin tapes with a thickness range 4–400 µm. For thicker components (0.5 mm up to 7 mm) lamination of green tapes is possible.

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