



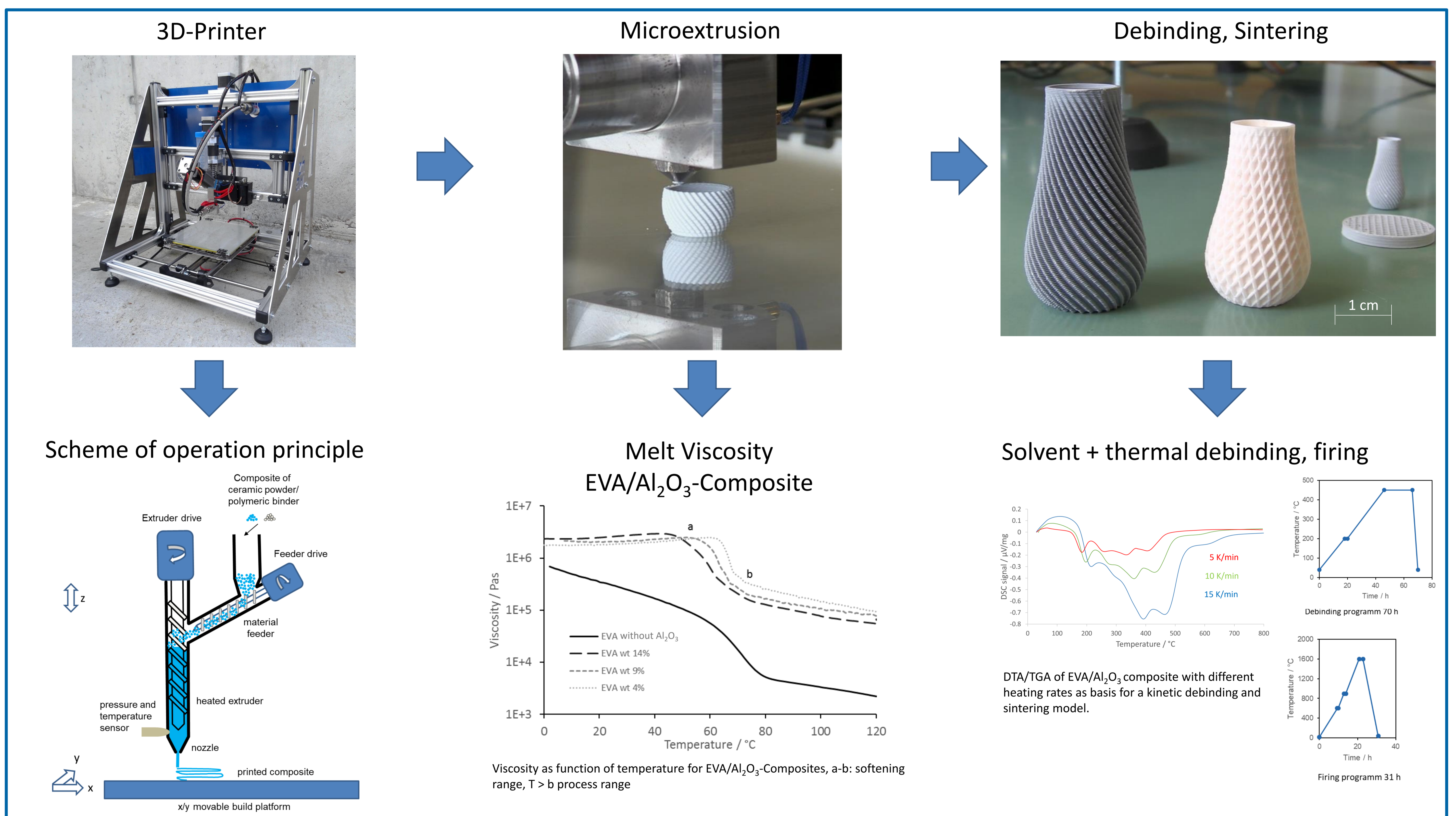
3D-printing of ceramics by micro extrusion of thermoplastic composite granulates

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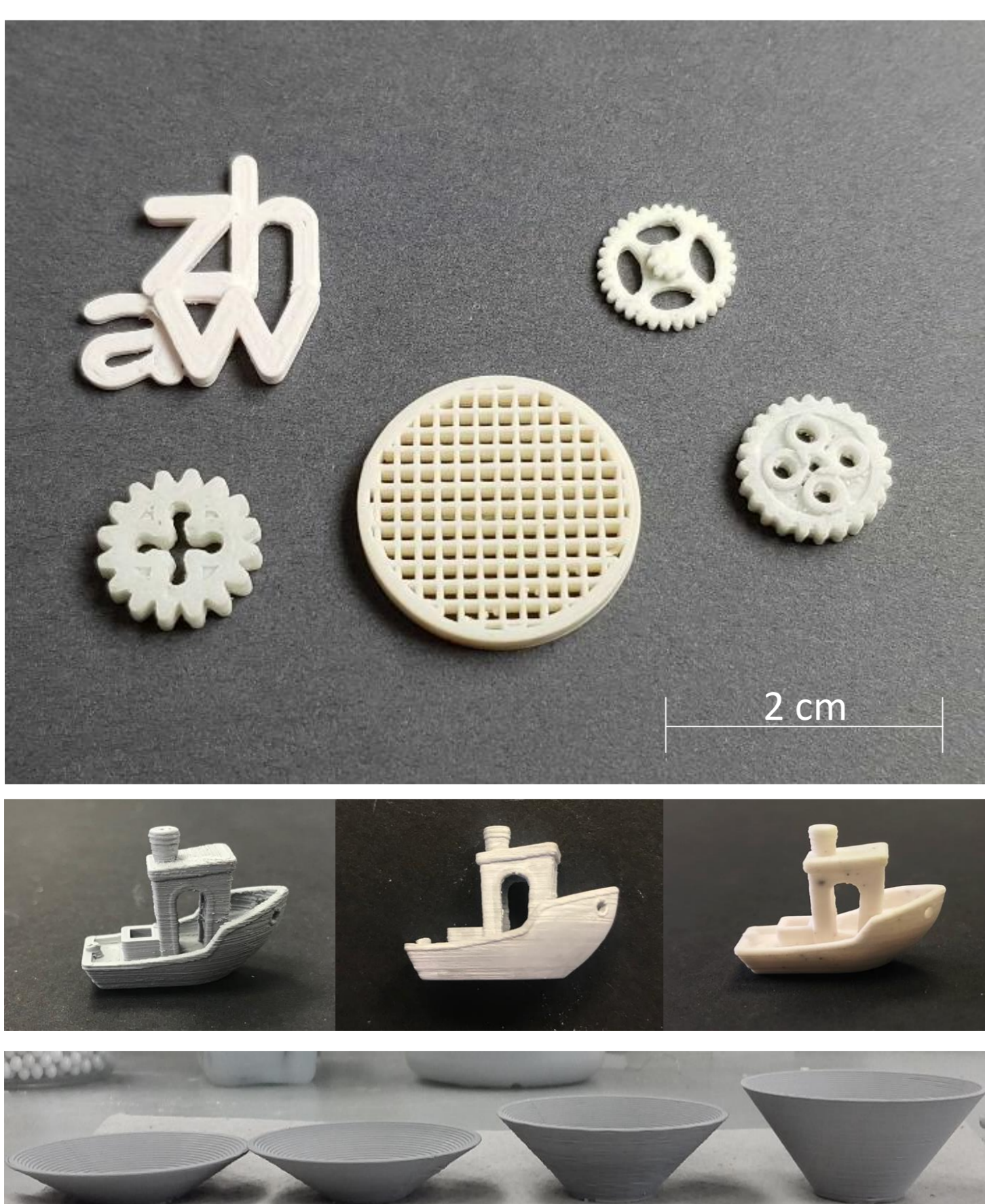
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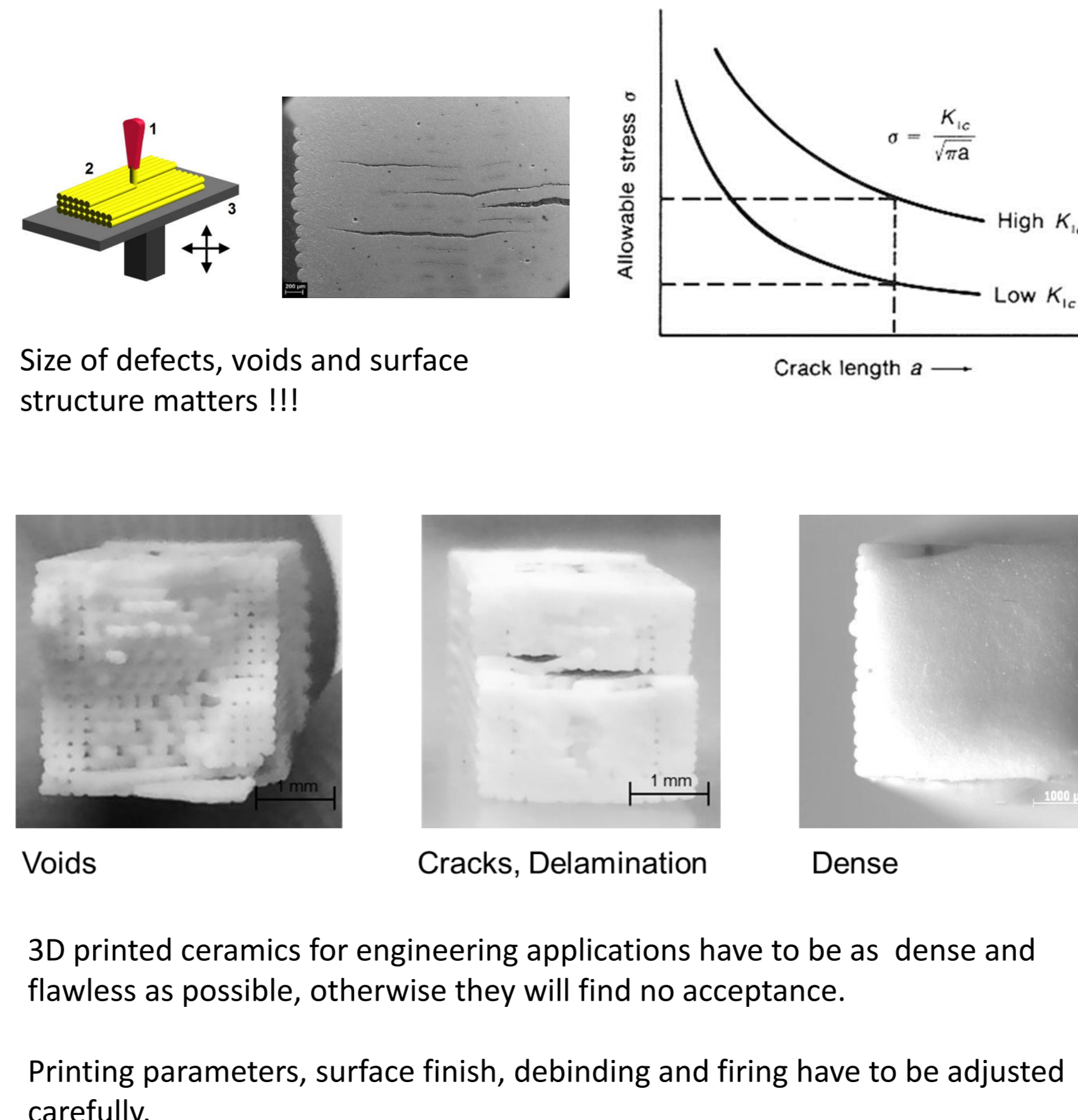
Fused filament fabrication (FFF) today is one of the most used standard technology of polymer printing. Many devices on all levels of professionalism are available and an open community is sharing experience, hardware, electronics and software via the web. Nevertheless, for new materials and especially for ceramics, development and production of filaments is necessary. This reduces the degree of freedom due to requirements of filament properties. For ceramics, feasibility of FFF is demonstrated, but commercial filaments just start to be available for only few materials. A novel, self-constructed 3D printer device based on micro extrusion of composite granulates is presented here. The printing still follows the basic principle of controlled deposition of a filament of molten material. Here, however, a granulate feed containing a surface modified ceramic powder dispersed in a thermoplastic polymer (Al₂O₃/EVA in this study) is used instead of a prefabricated filament. The breaking strength of bars produced in that way shows a dependence on the direction of the infill. A maximum Weibull modulus of 7.1 was reached with an infill in x direction and a breaking in y direction. The breaking strength reached 238 N/mm². Further materials like zirconia (ZrO₂) or hardmetal (WC/Co) have successfully been printed and will be further tested.



Examples of printed parts



Strength of ceramics produced by FFF



Investigation of strength in relation to print orientation

