Typical materials for the production of three-dimensional objects are thermoplastic materials. The production of three-dimensional metallic or ceramic objects by fused filament fabrication is only possible if the metal or ceramic material has a low melting point so that it can be heated and melted by the nozzle. If the metal or ceramic material has a high melting point, it is necessary to provide the metal or ceramic material in a binder composition to the extrusion nozzle. The binder composition usually comprises a thermoplastic material. When depositing the mixture of a metal or ceramic material in a binder on a base, the formed three-dimensional object is a so called „green body" which comprises the metal or ceramic material in a binder. To receive the desired metallic or ceramic object, the binder has to be removed and finally the object has to be sintered.

US 5,738,817 and US 5,900,207 describe a fused deposition modeling process for making a three-dimensional article by using a mixture of a particulate composition dispersed in a binder. The particulate composition comprises ceramic materials, elemental metals, metal alloys and/or steels. The binder consists of a polymer, a wax, an elastomer, a tackifier and a plasticizer. The binder is removed from the article by a burnout cycle during which the article is slowly heated to cause some of the components of the binder system to melt and flow out of the article. After these components are removed from the article, the temperature is increased and the other components of the binder are thermally decomposed and are removed from the article by diffusion and evaporation. This debinding process is very time consuming. Furthermore, the melting of the binder before evaporation leads to distortion of the article and moreover, the high temperatures may lead to blistering on the surface or internal cracking and/or delamination of the article.

US 2012/0033002 describes a process for the preparation of three-dimensional thermomagnetic objects by fused filament fabrication using a mixture of a thermomagnetic powder and a binder system. This binder system comprises polymers like polyesters, polysulfones, poly(ether sulfones) and styrene copolymers. After the printing of the three-dimensional object, the binder has to be removed. For this debinding step, very high temperatures are necessary. The high temperatures that are necessary for the debinding step may, as stated above, lead to blistering on the surface of the three-dimensional object, internal cracking and/or delamination of the article.

The object underlying the present disclosure is therefore to provide a mixture for the use in a fused filament fabrication (FFF) process comprising an inorganic powder and a binder which does not have the above-mentioned disadvantages of the prior art or has them only to a significantly reduced extent. Another object underlying the present disclosure is to provide a fused filament fabrication (FFF) process which should be

carried out more simply, safer and more cost efficient than described in the state of the art.

In an aspect, there is provided the use of a mixture (M) comprising

(a) from 40 to 70 % by volume of an inorganic powder (IP) based on the total volume of the mixture (M),

(b) from 30 to 60 % by volume based on the total volume of the mixture (M) of a binder (B) comprising

(b1) from 50 to 96 % by weight of at least one polyoxymethylene (POM) based on the total weight of the binder (B),

(b2) from 2 to 35 % by weight of at least one polyolefin (PO) based on the total weight of the binder (B),

(b3) from 2 to 40 % by weight of at least one further polymer (FP) based on the total weight of the binder (B)

in a fused filament fabrication process.

In another aspect, there is provided a process for the production of a three-dimensional green body by a fused filament fabrication process comprising the steps

i) providing the inventive mixture (M) to a nozzle,
ii) heating the mixture (M) to a temperature (T_M),
iii) depositing the mixture (M) into a build chamber using a layer-based additive technique to form the three-dimensional green body.

The „layer-based additive technique" for the purpose of the present invention is a technique wherein a first layer of material is deposited on a base in a build chamber to form a first layer of material, followed by the deposition of a second layer of material on the first layer of material, followed by the deposition of a third layer of material and so on. The number of layers deposited by the layer-based additive technique depends on the size of the three-dimensional object. Moreover, the number of layers depends on the thickness of the layers deposited.

It has surprisingly been found that a mixture (M), which comprises an inorganic powder (IP) as component (a) and a binder (B) as component (b), can be used in a fused filament fabrication process using the layer-based additive technique.