CLAIMS:

1. A twisted and heat-set Bulked Continuous side-by-side bi-component Filament (BCF) yarn (100), comprising:

a plurality of side-by-side bi-component filaments (100), each side-by-side bi-component filament of the plurality of side-by-side bi-component filaments having:

a first polymer component (112) forming a first side of the side-by-side bi-component filaments, wherein the first polymer component comprises ~~a first polyester, preferably~~ polybutylene terephthalate (PBT), in at least 25 and up to 75 volume percent of the filament in the BCF yarn, and

a second polymer component (114) forming a second side of the side-by-side bi-component filaments, wherein the second polymer component comprises ~~a second, different polyester, preferably one of~~ polyethylene terephthalate (PET) or polylactic acid (PLA) in at most 75 and down to 25 volume percent of the filament in the BCF yarn,

wherein the BCF yarn is obtained by a single-step continuous process comprising the process elements of: extruding, spinning, quenching, spin finish application, drawing, texturizing, cooling, and winding and the single-step continuous process is subsequently followed by steps of cabling and/or twisting in a range of 40 TPM to 350 TPM with at least one other ply and heat-setting for between 30 seconds and 3 minutes at a heat setting temperature range of 100℃ to 200℃ to form a heat-set BCF yarn that is heat set in the twisted configuration.

2. The yarn according to claim 1 wherein the twisted and heat-set BCF yarn exhibits an elongation to break in a range of 40% to 65%.

3. The yarn of claim 1 or claim 2, wherein the second polymer component comprises a recycled polyethylene terephthalate (PET).

4. The yarn of any preceding claim, wherein the first and the second sides together as a whole comprises a side by side full circle cross sectional shape, a side by side hollow circular cross sectional shape, a side-by-side full semi-circular cross-sectional shape, a side-by-side hollow semi-circular cross-sectional shape, a side-by-side full tri-lobal cross-sectional shape, a side-by-side hollow tri-lobal cross-sectional shape, a side-by-side full delta cross-sectional shape, a side-by-side hollow delta cross-sectional shape, a side-by-side full concave cross-sectional shape, a side-by-side hollow concave cross-sectional shape, a side-by-side full octa-lobal cross-sectional shape, a side-by-side hollow octa-lobal cross-sectional shape, a side-by-side full elliptical cross-sectional shape, a side-by-side hollow elliptical cross-sectional shape, a side-by-side full multi-lobal cross-sectional shape and a side-by-side hollow multi-lobal cross-sectional shape.

5. The yarn of any preceding claim, wherein at least one of the first and second polymer components ~~are~~ is solution-dyed, either using pigments or solvent dyes or a combination thereof or wherein at least one of the first and second polymer components is one of hank-dyed, space-dyed or yarn-dyed.

~~6. The yarn of any one of claims 1 to 4, wherein at least one of the first and second polymer components are one of hank-dyed, space-dyed or yarn-dyed.~~

~~7.~~6. The yarn of any preceding claim, wherein the number of side-by-side bi-component filaments in the twisted and heat set BCF yarn is in the range of 25 filaments to 1000 filaments.

~~8. The yarn of any preceding claim, wherein the yarn exhibits a denier per filament (DPF) ratio in the range of 0.5 DPF to 50 DPF.~~

~~10.~~7. The yarn of any preceding claim, wherein the twisted and heat-set yarn exhibits a denier per filament (DPF) ratio in the range of 0.5 DPF to 50 DPF and/or a linear density in a range of 600 denier to 6000 denier.

~~11. The yarn of any preceding claim, wherein the single-step continuous process further comprises intermingling prior to winding.~~

~~12. The yarn of any preceding claim, wherein, to obtain the BCF yarn, the first polymer and the second polymer are extruded, to obtain the plurality of side-by-side bi-component filaments that are grouped together to obtain a continuous side-by-side bi-component filament yarn, wherein extrusion preferably takes place at a gradual temperature having a range of 240℃ to 305℃ through a plurality of temperature zones, and at a pressure range of 60 bars to 130 bars.~~

~~13. The yarn of any preceding claim, wherein, to obtain the BCF yarn, the continuous side-by-side bi-component filament yarn is gradually quenched, preferably via an air flow comprising: a quenching air flow temperature having a range of 10℃ to 25℃, quenching air flow rate having a range of 0.1mps to 0.8mps, and quenching air flow pressure having a range of 1 mbars to 4 mbars.~~

~~14. The yarn of any preceding claim, wherein, to obtain the BCF yarn, the continuous side-by-side bi-component filament yarn is applied with spin finish and thereafter sequentially drawn at a drawing speed, preferably having a range of 760mpm to 3500mpm and even up to 4000mpm or 5000mpm, and a drawing temperature having a range of 75℃ to 200℃.~~

~~15. The yarn of any preceding claim, wherein, to obtain the BCF yarn, the continuous side-by-side bi-component filament yarn is texturized, preferably at a 4exturizing temperature range of 130°C to 200°C and a 4exturizing vacuum pressure range of -50 mbars to -150 mbars, and the continuous side-by-side bi-component filament yarn is cooled at a cooling drum speed, preferably having a range of 10 mpm to 60 mpm and a cooling drum vacuum having a range of -20 mbars to -80 mbars.~~

~~16. The yarn of any preceding claim, wherein, to obtain the BCF yarn, the continuous side-by-side bi-component filament yarn is optionally intermingled and wound as a final process element of the single-step continuous process.~~

~~18. The yarn of any preceding claim, wherein the BCF yarn is cabled and/or twisted in a range of 100 TPM (Twist per Meter) to 300 TPM.~~

~~20. The yarn of any preceding claim, wherein, the twisted BCF yarn is heat set in a heat setting temperature range of 130°C to 180°C, to obtain the twisted and heat-set BCF yarn.~~

~~22.~~8. The yarn of any preceding claim, wherein, the twisted and heat-set yarn is a frieze yarn.

~~23.~~9. A method for forming a twisted and heat-set Bulked Continuous side-by-side bi-component Filament (BCF) yarn, the method comprising:

extruding the first polymer component and the second polymer component, preferably at a gradual temperature having a range of 240°C to 305°C through a plurality of temperature zones and at a pressure range of 60 bars to 130 bars, to obtain a plurality of side-by-side bi-component filaments grouped together to obtain a continuous side-by-side bi-

component filament yarn, each side-by-side bi-component filament of the plurality of side-by-side bi-component filaments having,

the first polymer component forming a first side of the side-by-side bi-component filaments, wherein the first polymer component comprises ~~a first polyester, preferably~~ polybutylene terephthalate (PBT), in at least 25 and up to 75 volume percent of the filament of the BCF yarn, and

the second polymer component forming a second side of the side-by-side bi-component filaments, wherein the second polymer component comprises ~~a second, different polyester, preferably one of~~ poly(ethylene terephthalate) (PET) or recycled PET or poly-lactic acid (PLA), in at most 75 and down to 25 volume percent of the filament of the BCF yarn;

wherein extrusion of the first polymer component and the second polymer component takes place in a single-step continuous process including at least the process element of texturizing, to form a BCF yarn and the BCF yarn is wound to a bobbin; and subsequently

cabling and/or twisting the BCF yarn, preferably in a range of 40 TPM (Twist Per meter) to 350 TPM, more preferably in a range 100 TPM to 300 TPM, to obtain the continuous side-by-side bi-component filament yarn having twists;

heat setting the continuous side-by-side bi-component filament yarn with the twists, in a range of 85℃ to 200℃ to obtain a twisted and heat-set BCF yarn.

~~24. The method according to claim 19, wherein the twisted and heat-set BCF yarn has an elongation to break in a range of 40% to 65%.~~

~~25.~~10. The method of claim ~~19~~ 9 ~~or 20~~ further comprising, after extrusion of the first polymer component and the second polymer component, and prior to cabling /twisting and heat setting:

spinning the continuous side-by-side bi-component filaments;

gradually quenching the continuous side-by-side bi-component filaments, preferably via an air flow comprising a quenching air flow temperature having a range of 10 ℃ to 25 ℃, quenching air flow rate having a range of 0.1mps to 0.8mps, and quenching air flow pressure having a range of 1 mbars to 4 mbars;

spin finishing the continuous side-by-side bi-component filament yarn;

sequentially drawing the continuous side-by-side bi-component filament yarn, preferably at a drawing speed having a range of 760mpm to 3500mpm and even up to 4000mpm or 5000mpm, and a drawing temperature having a range of 75℃ to 200℃.;

texturizing the continuous side-by-side bi-component filament yarn, preferably at a texturizing temperature range of 130℃ to 200℃ and a texturizing vacuum pressure range of -50 mbars to -150 mbars;

cooling the continuous side-by-side bi-component filament yarn, preferably at a cooling drum speed having a range of 10mpm to 60mpm and a cooling drum vacuum having a range of -20mbars to -80mbars;

optionally, intermingling the continuous side-by-side bi-component filament yarn; and

winding the continuous side-by-side bi-component filament yarn.

~~26.~~11. The method of any one of the claims ~~19 to 21~~9 or 10, wherein the twisted BCF yarn is heat set in a heat setting temperature range of 100°C to 190°C, preferably 130°C to 180°C, to obtain the twisted and heat-set BCF yarn~~.~~.

~~27.~~12. The method of any one of claims ~~1~~9 to ~~22~~11, wherein a frieze process is carried out on the twisted and/or cabled BCF yarn prior to heat setting.

~~28.~~13. A floor covering material comprising:

a base backing;

a plurality of twisted and heat-set Bulked Continuous side-by-side bi-component Filament (BCF) yarns configured on the base backing, wherein the twisted and heat-set BCF yarns comprise yarns according to any one of claims 1 to 18.

~~29.~~14. The floor covering material according to claim ~~24~~13, wherein the floor covering material exhibits a Hexapod rating after 12000 cycles of more than 2.

~~30.~~15. The floor covering material as claimed in claim ~~24~~ 13 or ~~25~~14, wherein the BCF yarn is tufted, knitted, knotted or woven on the base backing.