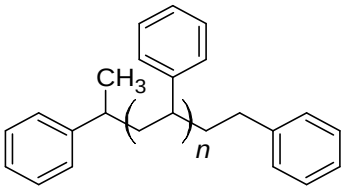
CLAIMS

[Claim 1]

A brominated polystyrene composition comprising a bromination product of a hydrogen mediated anionic polymerization of styrene (HMAPS) polystyrene, wherein the HMAPS polystyrene has a polymer microstructure that is greater than 97 wt% head to tail microstructure as depicted by the following polymeric structure:



and having a polymer chain length distributions wherein less than 3.0% of the polymer chains have one or more quaternary carbons in the polymer microstructure and coproduct distribution(s) arising from a fragmentation polymerization processes, wherein the microstructure and purity of the chain length distribution is determined *vide infra* from gas chromatographic analyses of the lowest molecular weight chains obtained from the HMAPS distributions, where n = 0 to n= 2.

[Claim 2]

The brominated polystyrene of Claim 1, wherein the polymer microstructure is greater than 98 wt% head to tail, and polymer chain length distributions is less than 2.0 wt% of the polymer chains have one or more quaternary carbons in the polymer microstructure and coproduct distribution(s) arising from a fragmentation polymerization processes.

[Claim 3]

The brominated polystyrene composition of Claim 1, wherein the HMAPS polystyrene has a molecular weight distribution as measured by GPC (UV detector) analysis of the chain length distribution characterized by having M_n in the range of from ~~about~~ 315 to ~~about~~ 934 Daltons; a M_w in the range of from ~~about~~ 392 to ~~about~~ 1705 Daltons; and a M_z is in the range of ~~about~~ 512 to ~~about~~ 2930 Daltons; a PD_n is in the range of ~~about~~ 1.24 to ~~about~~ 1.82; with a standard

deviation in the range of ~~about~~ 156 to ~~about~~ 849 Daltons and the asymmetry is in the range of ~~about~~ 1.40 to ~~about~~ 3.00.

[Claim 4]

The brominated polystyrene composition of Claim 1, wherein the HMAPS polystyrene has a molecular weight distribution as measured by GPC (UV detector) analysis of the chain length distribution characterized by having M_n is in the range of from ~~about~~ 400 to ~~about~~ 800 Daltons; M_w in the range of from ~~about~~ 600 to ~~about~~ 1200 Daltons; a PD_n in the range of ~~about~~ 1.35 to ~~about~~ 1.75; a standard deviation in the range of ~~about~~ 270 to ~~about~~ 550 Daltons and M_w 10% High of less than ~~about~~ 3300 Daltons.

[Claim 5]

The brominated polystyrene composition of Claim 1, wherein the HMAPS polystyrene has a molecular weight distribution as measured by GPC (UV detector) analysis of the chain length distribution characterized by having M_n in the range of from ~~about~~ 400 to ~~about~~ 800 Daltons; M_w in the range of from ~~about~~ 600 to ~~about~~ 1200 Daltons; M_z in the range of ~~about~~ 750 to ~~about~~ 1500 Daltons; PD_n in the range of ~~about~~ 1.35 to ~~about~~ 1.75; standard deviation in the range of ~~about~~ 270 to ~~about~~ 550 Daltons; the asymmetry is in the range of ~~about~~ 1.60 to ~~about~~ 2.2; and M_w 10% High of less than ~~about~~ 2400 Daltons.

[Claim 6]

The brominated polystyrene composition of Claim 1, wherein the brominated polystyrene has one or more of (i) a bromine content in the range of ~~about~~ 73 wt% to ~~about~~ 77 wt% based on the total weight of brominated polystyrene; (ii) , a thermal HBr value at 300°C below the detection limit of 50 ppm and no more than ~~about~~ 1000 ppm based upon the total weight of the brominated polystyrene; (iii) a thermogravimetric (TGA) weight loss of 5% occurring at a temperature greater than ~~about~~ 355°C to ~~about~~ 375°C; and (iv) a glass transition temperature in the range of ~~about~~ 110°C to ~~about~~ 155°C.

[Claim 7]

The brominated polystyrene composition of Claim 1, wherein the brominated polystyrene has two or more of (i) a bromine content in the range of ~~about~~ 73 wt% to ~~about~~ 77 wt% based on the total weight of brominated polystyrene; (ii) , a thermal HBr value at 300°C below the detection limit of 50 ppm and no more than ~~about~~ 1000 ppm based upon the total weight of the brominated polystyrene; (iii) a thermogravimetric (TGA) weight loss of 5% occurring at a temperature greater than ~~about~~ 355°C to ~~about~~ 375°C; and (iv) a glass transition temperature in the range of ~~about~~ 110°C to ~~about~~ 155°C.

[Claim 8]

The brominated polystyrene composition of Claim 1, wherein the brominated polystyrene has (i) a bromine content in the range of ~~about~~ 73 wt% to ~~about~~ 77 wt% based on the total weight of brominated polystyrene; (ii) , a thermal HBr value at 300°C below the detection limit of 50 ppm and no more than ~~about~~ 1000 ppm based upon the total weight of the the brominated polystyrene; (iii) a thermogravimetric (TGA) weight loss of 5% occurring at a temperature greater than ~~about~~ 355°C to ~~about~~ 375°C; and (iv) a glass transition temperature in the range of ~~about~~ 110°C to ~~about~~ 155°C.

[Claim 9]

The brominated polystyrene composition of Claim 3, wherein the brominated polystyrene has one or more of (i) a bromine content in the range of ~~about~~ 73 wt% to ~~about~~ 77 wt% based on the total weight of brominated polystyrene; (ii) , a thermal HBr value at 300°C below the detection limit of 50 ppm and no more than ~~about~~ 1000 ppm based upon the total weight of the brominated polystyrene; (iii) a thermogravimetric (TGA) weight loss of 5% occurring at a temperature greater than ~~about~~ 355°C to ~~about~~ 375°C; and (iv) a glass transition temperature in the range of ~~about~~ 110°C to ~~about~~ 155°C.

[Claim 10]

The brominated polystyrene composition of Claim 3, wherein the brominated polystyrene has two or more of (i) a bromine content in the range of ~~about~~ 73 wt% to ~~about~~ 77 wt% based on the total weight of brominated polystyrene; (ii) , a thermal HBr value at 300°C

below the detection limit of 50 ppm and no more than ~~about~~ 1000 ppm based upon the total weight of the brominated polystyrene; (iii) a thermogravimetric (TGA) weight loss of 5% occurring at a temperature greater than ~~about~~ 355°C to ~~about~~ 375°C; and (iv) a glass transition temperature in the range of ~~about~~ 110°C to ~~about~~ 155°C.

[Claim 11]

The brominated polystyrene composition of Claim 3, wherein the brominated polystyrene has (i) a bromine content in the range of ~~about~~ 73 wt% to ~~about~~ 77 wt% based on the total weight of brominated polystyrene; (ii) a thermal HBr value at 300°C below the detection limit of 50 ppm and no more than ~~about~~ 1000 ppm based upon the total weight of the brominated polystyrene; (iii) a thermogravimetric (TGA) weight loss of 5% occurring at a temperature greater than ~~about~~ 355°C to ~~about~~ 375°C; and (iv) a glass transition temperature in the range of ~~about~~ 110°C to ~~about~~ 155°C.

[Claim 12]

The brominated polystyrene composition of Claim 2, wherein the HMAPS polystyrene has a molecular weight distribution as measured by GPC (UV detector) analysis of the chain length distribution characterized by having M_n in the range of from ~~about~~ 315 to ~~about~~ 934 Daltons; a M_w in the range of from ~~about~~ 392 to ~~about~~ 1705 Daltons; and a M_z is in the range of ~~about~~ 512 to ~~about~~ 2930 Daltons; a PD_n is in the range of ~~about~~ 1.24 to ~~about~~ 1.82; with a standard deviation in the range of ~~about~~ 156 to ~~about~~ 849 Daltons and the asymmetry is in the range of ~~about~~ 1.40 to ~~about~~ 3.00;

[Claim 13]

The brominated polystyrene composition of Claim 12, wherein the brominated polystyrene has one or more of (i) a bromine content in the range of ~~about~~ 73 wt% to ~~about~~ 77 wt% based on the total weight of brominated polystyrene; (ii) , a thermal HBr value at 300°C below the detection limit of 50 ppm and no more than ~~about~~ 1000 ppm based upon the total weight of the brominated polystyrene; (iii) a thermogravimetric (TGA) weight loss of 5% occurring at a temperature greater than ~~about~~ 355°C to ~~about~~ 375°C; and (iv) a glass transition temperature in the range of ~~about~~ 110°C to ~~about~~ 155°C.

[Claims 14]

The brominated polystyrene composition of Claim 12, wherein the brominated polystyrene has two or more of (i) a bromine content in the range of ~~about~~ 73 wt% to ~~about~~ 77 wt% based on the total weight of brominated polystyrene; (ii) , a thermal HBr value at 300°C below the detection limit of 50 ppm and no more than ~~about~~ 1000 ppm based upon the total weight of the brominated polystyrene; (iii) a thermogravimetric (TGA) weight loss of 5% occurring at a temperature greater than ~~about~~ 355°C to ~~about~~ 375°C; and (iv) a glass transition temperature in the range of ~~about~~ 110°C to ~~about~~ 155°C.