polymer matrix, polymer composition and polymer coating.

Summary

[0005] There is provided a polymer matrix comprising two hybrid polymer networks wherein at least one hybrid network is a covalently bound network that is interlocked with at least one physically bound hybrid network. According to a first aspect, there is provided a polymer matrix comprising two hybrid polymer networks wherein at least one hybrid network is a covalently bound network that is interlocked with at least one physically bound hybrid network and wherein the physically bound hybrid network is obtained by polymerization of silane cages in the presence of a high molecular weight polymer. In an embodiment, the hybrid polymer networks may be silane particles of nano or micro meter size.

[0006] Advantageously, assimilation of nano-sized inorganic fillers of a specific shape into polymer coating matrices may significantly promote the association between the filler and matrix, which may facilitate the translation of mechanical stress into the inorganic filler through the matrix. For instance, nano-scale silica particles act to reduce the visco-response component, resulting in improvement of scratch and abrasion resistance. Further advantageously, the nano or micro meter sized silane particles may comprise manifold organic arms that enable thermodynamic compatibility of the particles with the host polymer matrix through the chain fixation effect of the organic arms.

[0007] The polymer matrix may therefore advantageously integrate the nano or micro meter sized inorganic particles such as silane particles as part of the cross-linked polymer network. This may give rise to the particle-chain structure, which is more favourable than the traditional point molecule-to-chain structure, as it allows polymer chain coiling.

[0008] Further advantageously, the polymer matrix may utilise the nano-particles as the primary structural foci for upholding the mechanical strength of the coating matrix. The polymer matrix may therefore avoid the use of molecular cross-linkers that are used in traditional cross-linked polymer networks where the main mechanical supporting foci are covalent bonds between or among different polymer chains that do not permit tunability of hardness and flexibility of the polymer network. The hybrid networks may enable this tenability through altering relative spatial occupation of polymer chains that is recoverable upon the removal of external shear stress.

[0009] More advantageously, the covalently bound network may provide an elastic framework for responding to shear stress, while the physically bound hybrid network may provide a viscoelastic framework to offer chain yielding that buffers high shear stress by its orderly packed chain domains. Advantageously, this strategy of integrating nano or micro meter sized inorganic particles such as silane particles into the polymer matrix (that is, the integration of the covalently bound network and the physically bound network) may lead to improvements in shear modulus while permitting the elastic strain (flexibility) and yield strength (hardness) to be tuned for improved