

Infusible Nuclear Fuel Meta-material for Powerful Back-Flights from Far Deep Cosmic-Space Explorations

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Every form of a material substance (captured asteroid rocks, sands, ices ...etc.) can be transformed into highly accelerated plasma-jet ejections *via* giant magneto-electric pulses throughout the propulsive rocket-engine thrusters. Solely an unconventional high-temperature and powerful nuclear reactor can produce the above huge amounts of energy demands. Namely, the thermionic and magneto-hydrodynamic MHD converters in avalanche configuration chain can work at their best performance if the highest obtainable temperatures are given at their input. In view of these facts the easier synthesis and facile production of classic micro-crystalline or liquid nuclear fuels are not the right targets: inside the fission milieu with multiple-knocking neutrons every compounded matrix (especially actinide and trans-actinide oxides) decomposes, the fuel performances are irreversibly degraded and lost. Instead of this, the nuclear fuel synthesis is redirected to obtain meta-structured 3D spider-like networks of tetrahedral amorphous (ta-C) carbon atoms interconnected together with hot-living and pivoting dangling bonds which are also continuously generated inside the knocked fission-milieu. To speed-up the overall synthetic carbon/carbide processes into higher rates of matrix growth some bigger molecules with preformed multiple pyramidal sp^3 carbon groups are preferred to be the main builder-up substances and reactive add-in modular-blocks. Simultaneous introduction of volatile actinide/trans-actinide halide vapors into high temperature reaction mixtures blasts copious releases of free halogen atoms which are also good scavengers of residual hydrogen atoms from the 3D amorphous carbon proto-network. Namely, the freshly unpaired electrons of carbon living radicals suddenly and fuzzily interconnect the pyramidal sp^3 modular-blocks together or else act as a harpoon to pick-up and hold the sub-coordinated radio-nuclide atoms to rattle into empty spider-like (ta-C) trap-cavities. The dense spongiform carbon matrix increases its size without crystallographic axes and periodicity – as an isotropic not-compounded material tractable by *fourth* or even *higher rank* tensor approximation. Although the long-range operating elements of symmetry are broken the short range diamondoid 3D (ta-C) motif persists in time and space which allows better cooling achievements *via* higher thermal conductivity throughout carbo-pyramidal vibrations – noticeably different are the results if compared with graphite, oxides or other compounded materials. The sub-coordinated rattling Thorium atoms are confined in the jail of the harsh-working kernel-milieu when the continuously generated dangling bonds perform highly reactive spiderish-healing actions to counteract the kinetics of the self-disintegration events inside the knocked carbon network. The complex spider-like arrangement essentially reassembles the (ta-C) allotrope meta-material with spatially/temporally disordered structure but without catastrophic phase transitions phenomena for up to near 4,000 °C. Multiple synergistic effects open new heuristic approaches to potentiate the fission fuel efficiency. Moreover, in the attempts to lower the inertial mass of the spacecrafts we must not forget the fact that in the overall production processes for the same amount of released nuclear energy the challenging ratio of involved masses holds:

$$(\text{Uranium mass}) : (\text{Thorium mass}) = 200 : 1$$