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(71) Applicant: **CHAIRMAN, DEFENCE RESEARCH & DEVELOPMENT ORGANISATION** [IN/IN]; Ministry of Defence, Govt. of India, DRDO Bhawan, Rajaji Marg., New Delhi 110011 (IN).

(72) Inventor: **RAM, Jasa**; Defence Laboratory, Ratanada Palace, Rajasthan, Jodhpur 342011 (IN).

(74) Agent: **KOUL, Sunaina** et al.; Rahul Chaudhry & Partners, RCY House, C-235, Defence Colony, New Delhi 110024 (IN).

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(54) Title: THERMOELECTRIC MATERIALS WITH NETWORKED HETEROSTRUCTURES PROVIDING ENHANCED THERMOELECTRIC EFFICIENCY AND PREPARATION METHOD THEREOF

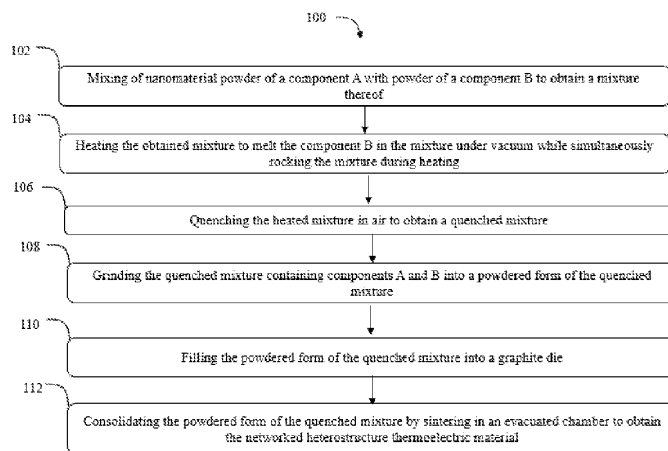


Fig: 1

(57) Abstract: A facile and scalable method for preparation of networked heterostructures in thermoelectric materials at nano-scale is disclosed. The preparation method involves rocking the melted form of component B with nanomaterial of component A under inert environment, followed by controlled consolidation. Honeycomb like network of component B having filled-in voids by component A forms heterostructure B/A at nano-scale, where component A and B can be metal, semiconductor or insulator. The method of thermoelectric figure of merit (ZT) enhancement by quantum confinement effects and its polarity reversal by carrier injection from barrier layer in nano-sized heterostructures are also disclosed. ZT > 2 in both p-type and n-type metal- semiconductor bulk heterostructures of formula $D_3/Bi_xSb_{2-x}D_yM_{3-y}$ are demonstrated. The method of ZT enhancement is also applicable to semiconductor-semiconductor heterostructures as well as superlattice structures. High ZT materials find usages in power generation, Peltier cooling and refrigeration, thermal infrared sensing and imaging, and thermal infrared display.

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