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- (71) **Applicant:** LYTEN, INC. [US/US]; 145 Baytech Drive, San Jose, California 95134-2303 (US).
- (72) **Inventors:** BOUL, Peter J.; 145 Baytech Drive, San Jose, California 95134-2303 (US). POELMA, Saemi Oh; 145 Baytech Drive, San Jose, California 95134-2303 (US). LANNING, Bruce; 145 Baytech Drive, San Jose, California 95134-2303 (US). HINES, Margaret; 145 Baytech Drive, San Jose, California 95134-2303 (US).

NICOLE, Jacques F.; 145 Baytech Drive, San Jose, California 95134-2303 (US). STOWELL, Michael W.; 145 Baytech Drive, San Jose, California 95134-2303 (US). COOK, Daniel; 145 Baytech Drive, San Jose, California 95134-2303 (US). RUMINSKI, Anne; 145 Baytech Drive, San Jose, California 95134-2303 (US). JUBINSKY, Matthew; 145 Baytech Drive, San Jose, California 95134-2303 (US).

(74) **Agent:** PARADICE III, William L. et al.; Paradise & Li LLP, 1630 S Delaware St., Suite 5086, San Mateo, CA 94402 (US).

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(54) **Title:** CEMENT COMPOSITIONS WITH 3D GRAPHENE CARBONS

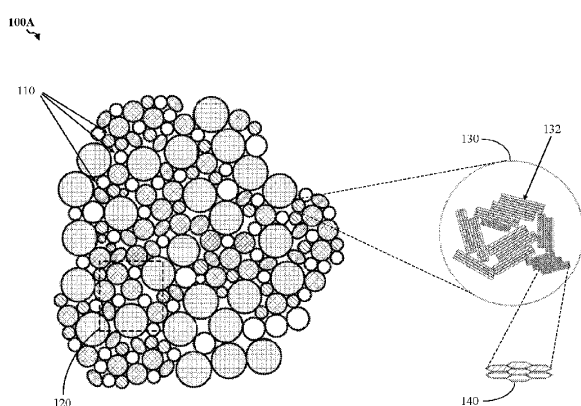


Figure 1A

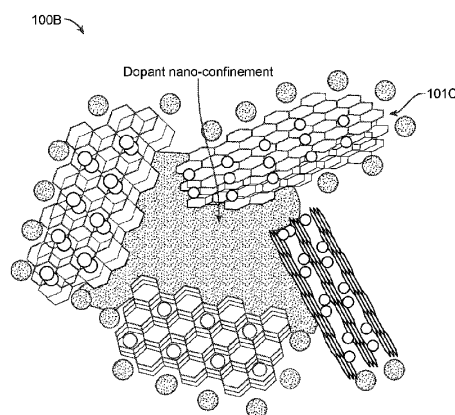


FIG. 1B

(57) **Abstract:** Cement compositions including ordinary Portland cement, a secondary cementitious material (SCM) including one or more of pozzolan, metakaolin, limestone, or gypsum in an amount corresponding to at least approximately 70% replacement level of ordinary Portland cement, and between about 0.05% bwoc and 2% bwoc of aggregates of 3-dimensional graphene (3DG) carbons. The cement compositions regulate nucleation and time-lapsed growth of calcium silica hydrates during initial hydration. The 3DG carbons include one or more of graphene nanoplatelets orthogonally joined to each other to form a 3D porous graphene scaffold structure. The 3DG carbons may also include a plurality of aggregates of carbon nanoparticles characterized by a plurality of porous concentric shells including graphene, where each shell encloses a porous carbon region and an interconnected porous network disposed in each carbon region and in fluid communication with contiguous carbon regions.

[Continued on next page]

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