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(54) Title: LARGE-AREA/WAFER-SCALE CMOS-COMPATIBLE 2D-MATERIAL INTERCALATION DOPING TOOLS, PROCESSES, AND METHODS, INCLUDING DOPING OF SYNTHESIZED GRAPHENE

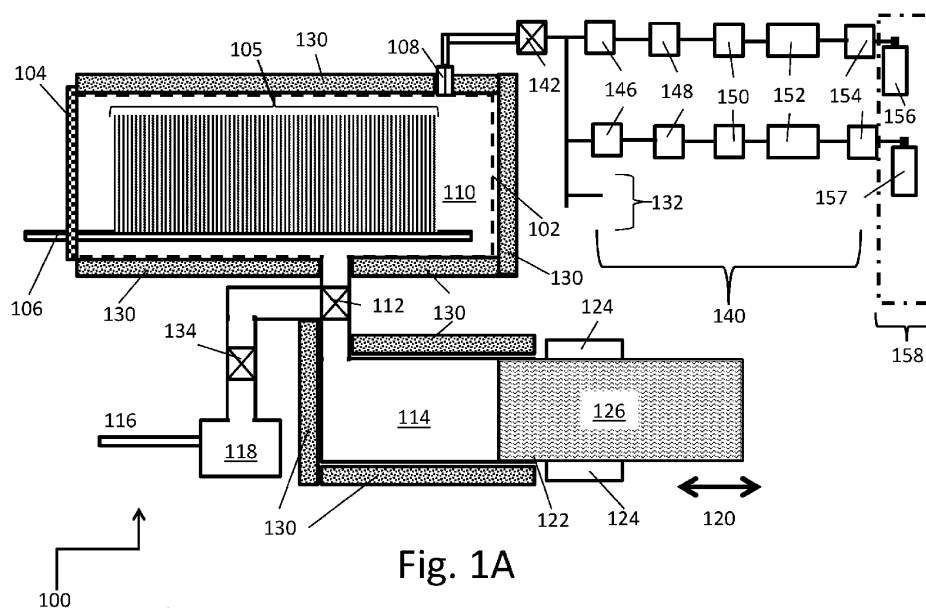


Fig. 1A

Batch/single; Dopant = gaseous; substrate pressurization = gaseous

(57) **Abstract:** An intercalation doping apparatus including: a reactor chamber where single or multiple wafers or substrates (SoM-WoSubs) are disposed within the reactor chamber, where SoMWoSubs have a diameter or a side distance from 25 mm to 450 mm; a heater, where the heater is configured to provide heat to the SoMWoSubs disposed within the reactor chamber, where the SoMWoSubs include a temperature from 25°C to 500°C; where pressure is applied to at least one surface of the SoMWoSubs disposed within the reactor chamber within a range of 2 bar to 500 bar; and a dopant application apparatus, where the dopant application apparatus includes at least valves and tubing which bring dopants from outside to within the reactor chamber and includes at least a dopant crucible disposed within the reactor chamber, where the dopants include material in solid, liquid, or gaseous phase, and where the dopants include

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