CLAIMS

1. A method of forming a semiconductor device, the method comprising:

performing an anisotropic etch process on a semiconductor material on a semiconductor substrate to expose a surface in the semiconductor material, the surface disposed between an existing structure of the semiconductor device and a bulk semiconductor portion of the semiconductor substrate on which the semiconductor material is formed;

performing an isotropic etch process on an exposed sidewall to recess the semiconductor material that is disposed between the existing structure and the bulk semiconductor portion of the semiconductor substrate by a distance to form a cavity;

in situ measuring the distance that the semiconductor material has been recessed after isotropic etch;

forming a layer of deposited material via a selective epitaxial growth (SEG) process on a surface of the cavity, the substrate not subjected to a pre-clean process between formation of the cavity and SEG;

adjusting the SEG process based on the distance that the semiconductor material has been recessed; and

forming a doped region on the layer of deposited material via a selective epitaxial growth (SEG) process, wherein the doped region comprises one or more of phosphorus (P), arsenic (As), antimony (Sb), bismuth (Bi), lithium (Li), boron (B), aluminum (Al), gallium (Ga), and indium (In), the doped region having a dopant concentration in a range of about $1x10^{20}$ atoms/cm^3 to about $1x10^{22}$ atoms/cm^3,

wherein the isotropic etch process, the SEG process, and the *in situ* measuring are performed in a single platform under vacuum processing.

2. The method of claim 1, wherein the isotropic etch occurs in a first process chamber and the method further comprises moving the substrate from the first process chamber to a second process chamber for the SEG process.

3. The method of claim 1, further comprising epitaxial growing a portion of the semiconductor material prior to forming the layer of deposited material.

4. The method of claim 1, wherein the distance that the semiconductor material has been recessed is measured by refractometry.

5. The method of claim 1, wherein the isotropic etch process comprises an etch process selective to the semiconductor material.

6. The method of claim 5, wherein the isotropic etch process comprises a chemical vapor etch process that includes exposing the exposed sidewall to at least one of HCl, GeH_4 or and Cl_2.

7. The method of claim 1, wherein forming the layer of deposited material comprises filling the cavity with the deposited material.

8. The method of claim 1, further comprising, prior to forming the layer of deposited material, depositing a carbon-containing material on the surface of the cavity, wherein the carbon-containing material includes a silicon-carbon-phosphorus (SiCP) material.

9. The method of claim 8, wherein the SiCP material includes in the range of about 0.1 to 2.0 atomic percent carbon and in the range of about about $1x10^{20}$ atoms/cm^3 to $1x10^{21}$ atoms/cm^3 phosphorus.

10. The method of claim 1, wherein performing the isotropic etch process on the exposed sidewall to form the cavity in the semiconductor material comprises removing semiconductor material until a portion of the semiconductor material that comprises a phosphorus-doped bulk semiconductor material is exposed.

11. The method of claim 1, wherein the deposited material comprises an n-type dopant comprising arsenic (As), and the selective epitaxial growth (SEG) process includes exposing the surface of the cavity to at least one of $AsCl_3$, TBA, or AsH_3 and at least one of dichlorosilane (DCS), HCl, SiH_4, Si_2H_6, or Si_4H_{10}.

12. The method of claim 11, wherein forming the layer of deposited material comprises filling the cavity with arsenic-doped material having an arsenic concentration sufficient to produce a targeted tensile strain within the deposited material.

13. The method of claim 1, wherein the deposited material comprises a p-type dopant comprising boron (B), and the selective epitaxial growth (SEG) process includes exposing the surface of the cavity to one or more of borane, diborane or plasmas thereof.

14. The method of claim 1, wherein the layer of additional deposited material is formed without exposing the layer of deposited material formed on the surface of the cavity to air.