CLAIMS

1. A method of processing a substrate, comprising:

positioning the substrate in a processing chamber;

flowing a germanium precursor into the processing chamber;

forming a metal halide stressor precursor in a contact chamber coupled to the processing chamber, wherein the metal halide stressor precursor comprises chlorine or fluorine, and wherein the forming the metal halide stressor precursor comprises subliming a solid source of metal halide crystals into a flowing carrier gas stream comprising N_2, H_2, Ar, or He;

flowing the metal halide stressor precursor into the processing chamber; and

growing a germanium stressor layer epitaxially on the substrate, wherein the germanium stressor layer comprises metal atoms disposed in a germanium matrix with a resulting metal atom concentration in the germanium stressor layer of between about 1% and about 12%, wherein the metal atoms are from the metal halide stressor precursor.

2. The method of claim 1, further comprising flowing a selectivity control species into the processing chamber.

3. The method of claim 2, wherein the substrate comprises dielectric regions and semiconductive regions, and the selectivity control species controls relative growth rate of the germanium stressor layer on the dielectric and semiconductive regions.

4. The method of claim 3, wherein the selectivity control species selectively removes material deposited on the dielectric regions of the substrate.

5. The method of claim 2, wherein the growing the germanium stressor layer epitaxially on the substrate comprises maintaining the processing chamber at a pressure between about 5 Torr and about 80 Torr and a temperature between about 150°C and about 400°C.

6. The method of claim 5, wherein a flow rate ratio of the metal halide stressor precursor to the selectivity control species is between about 2:1 and about 100:1.

7. The method of claim 1, wherein the metal halide stressor precursor comprises organotin chlorides having the general formula R_xSnCl_y, wherein R is methyl or t-butyl, x is 1 or 2, and y is 2 or 3.

8. The method of claim 1, wherein the germanium precursor is germane or digermane, and the metal halide stressor precursor is an organotin chloride.

9. The method of claim 1, wherein the germanium precursor and the metal halide stressor precursor flow across the processing chamber from one side of the processing chamber to an opposite side of the processing chamber.

10. The method of claim 1, wherein the germanium precursor and the metal halide stressor precursor flow into the processing chamber through a showerhead.

11. A method of processing a substrate, comprising:

positioning the substrate in a processing chamber;

flowing a first gas comprising a germanium hydride into the processing chamber;

forming a metal halide stressor precursor in a contact chamber coupled to the processing chamber, wherein the forming the metal halide stressor precursor comprises subliming a solid source of metal halide crystals into a flowing carrier gas stream comprising N_2, H_2, Ar, or He in the contact chamber, wherein the metal halide stressor precursor comprises chlorine or fluorine;

flowing a second gas comprising the metal halide stressor precursor into the processing chamber; and

growing a germanium stressor layer epitaxially on the substrate, wherein the germanium stressor layer comprises metal atoms disposed in a germanium matrix with a resulting metal atom concentration in the germanium stressor layer of between about 1% and about 12%, wherein the metal atoms are from the metal halide stressor precursor.

12. The method of claim 11, wherein the metal halide stressor precursor comprises an organotin chloride.

13. The method of claim 12, further comprising flowing a selectivity control species into the processing chamber.

14. The method of claim 13, wherein a flow rate ratio of the metal halide stressor precursor to the selectivity control species is between about 2:1 and about 100:1.

15. The method of claim 13, wherein the organotin chloride has the general formula R_xSnCl_y, wherein R is methyl or t-butyl, x is 1 or 2, and y is 2 or 3.

16. The method of claim 13, wherein the growing the germanium stressor layer epitaxially on the substrate comprises maintaining the processing chamber at a pressure between about 5 Torr and about 80 Torr and a temperature between about 150°C and about 400°C.

17. A method of processing a substrate, comprising:

positioning the substrate in a processing chamber;

flowing a first gas comprising a germanium hydride into the processing chamber;

forming an organotin chloride in a contact chamber coupled to the processing chamber, wherein the organotin chloride has the general formula R_xSnCl_y, wherein R is methyl or t-butyl, x is 1 or 2, and y is 2 or 3 wherein the forming the organotin chloride comprises subliming a solid source of metal halide crystals into a flowing carrier gas stream comprising N_2, H_2, Ar, or He;

flowing a second gas comprising a stressor precursor into the processing chamber;

flowing a selectivity control species into the processing chamber; and

growing a germanium stressor layer epitaxially on the substrate, wherein the germanium stressor layer comprises metal atoms disposed in a germanium matrix with a resulting metal atom concentration in the germanium stressor layer of between about 1% and about 12%, wherein the metal atoms are from the organotin chloride.

18. The method of claim 17, wherein the selectivity control species is a halide gas.

19. The method of claim 18, wherein the germanium hydride, the organotin chloride, and the halide gas flow across the processing chamber from one side of the processing chamber to an opposite side of the processing chamber.