WHAT IS CLAIMED IS:

1. A method of making a ~~chalcogen~~selenium-containing photoabsorbing composition, comprising the steps of:

(a) sputtering metals comprising Cu and Ga using at least one first sputtering target in the presence of one or more chalcogens comprising Se to form a Se-containing precursor of the chalcogen-containing photoabsorber~~(i) one or more second targets containing a chalcogen, or (ii) a chalcogen-containing gas or vapor to form a precursor of the chalcogen-containing photoabsorbing composition~~, wherein the Se-containing precursor includes a sub-stoichiometric amount of ~~at least~~the one chalcogen throughout the precursor or in selected areas of the precursor~~, wherein the at least one chalcogen is selected from Se and/or S~~; and

(b) while the precursor comprises Se throughout the precursor or in selected areas of the precursor, subjecting the Se-containing precursor to a ~~chalcogenization~~ thermal treatment in the presence of one or more chalcogens comprising Se ~~and optionally S~~ to convert the precursor into a chalcogenide photoabsorbing material.

2. The method of claim 1, wherein step (a) comprises co-sputtering the metals and the chalcogens using at least one sputtering target that has a substoichiometric ~~chalcogen~~ Se content ~~and the chalcogens during co-sputtering do not include Te~~.

3. The method of any preceding claim, wherein the precursor is at least partially amorphous.

4. The method of any preceding claim, wherein step (a) comprises selectively incorporating at least one ~~chalcogen~~ Se into one or more portions of the precursor, wherein the at least one ~~chalcogen~~ Se is selectively incorporated into at least one boundary region of the precursor, and wherein Ga and at least one chalcogen are selectively co-incorporated into one or more portions of the precursor.

5. The method of any preceding claim, wherein step (a) comprises sputtering at least one chalcogen-containing target to form at least a portion of the precursor containing Se and/or wherein step (a) comprises sputtering at least one target in the presence of a chalcogen containing gas or vapor.

6. The method of any preceding claim, wherein the precursor comprises at least two metals selected from Cu, In, and Ga, and the atomic ratio of chalcogen to the cumulative amount of metals in the precursor is in the range from 0.01 to 0.8.

7. The method of any preceding claim, wherein step (a) comprises forming a precursor comprising a plurality of layers and the at least one chalcogen comprising Se is incorporated into some, but not all the layers of the precursor

and wherein Ga is co-incorporated into at least one layer of the precursor that includes at least one chalcogen comprising Se and is not included in at least one other layer of the precursor.

8. The method of claim 7, wherein the precursor has a top and a bottom, and wherein the precursor comprises a first region proximal to the bottom, a second region proximal to the top, and at least one region interposed between the first and second regions, wherein at least one chalcogen is selectively incorporated into at least one of the first and second regions and is not included in at least one of the interposed regions and wherein Ga is selectively co-incorporated into at least one of the regions that also includes at least one chalcogen.

~~9. A photovoltaic device comprising a photoabsorbing film made by any process of claims 1 through 8.~~

9~~10~~. A photovoltaic device, comprising a chalcogen-containing photoabsorbing film having a top surface and a bottom surface, said photoabsorbing film comprising:

a void content of 0.5 to 50%; and

0.1 to 60 atomic percent Ga at least in a first boundary region proximal to the bottom surface of the photoabsorbing film and/or a second boundary region proximal to the top surface of the photoabsorbing film, wherein the atomic percent Ga is based on the total composition of the corresponding boundary region, and wherein at least one additional region is interposed between the first and second boundary regions, wherein the additional region includes a reduced Ga content relative to the first and second boundary regions.

~~11~~10. The photovoltaic device of claim ~~10~~9, wherein the photoabsorbing film incorporates ingredients comprising Cu, In, Ga, and Se.

~~12~~11. The photovoltaic device of claim ~~10~~9 or ~~11~~10, wherein at least one of the first and/or second boundary regions has a thickness in the range from 10 nm to 300 nm and the at least one boundary region comprises from 2 to 10 atomic percent Ga based on the total composition of the at least one boundary region.

~~13~~12. The photovoltaic device of any of claims ~~10~~9, ~~11~~10 or ~~12~~11 wherein at least more than 10% of the total void area includes voids that contact inner surfaces of the photoabsorbing film only and do not contact the CIGS-Mo interface.

~~14~~13. A precursor film of a chalcogen-containing photoabsorbing material, said precursor comprising from 0.1 to 60 atomic percent Ga selectively co-incorporated into one or more portions of the precursor with at least one chalcogen based upon the total composition of said portion; and wherein the precursor includes a sub-stoichiometric amount of a chalcogen based upon the overall composition of the precursor film, and wherein at least one additional region is interposed between the first and second boundary regions, wherein the additional region includes a reduced Ga content relative to the first and second boundary regions.