

CLAIMS:

1. Neutron shielding comprising:
a plurality of absorption layers, each comprising tungsten boride or tungsten carbide; and
at least one moderating layer comprising a metal hydride;
wherein each moderating layer is between at least two absorption layers.
2. Neutron shielding according to claim 1, wherein the metal hydride comprises one or more of the metals from groups 4, 5 and 6 from the periodic table and/or yttrium, beryllium, gadolinium, or uranium.
3. Neutron shielding according to claim 2, wherein the metal hydride comprises one or more of hafnium, niobium, tantalum, titanium, yttrium, and zirconium.
4. Neutron shielding according to any preceding claim, wherein the metal hydride comprises at least 5 metals, each metal having an atomic proportion of 5 mol.% to 50 mol. % compared to the total number of metal atoms in the metal hydride.
5. Neutron shielding according to any preceding claim, wherein the metal hydride has a ratio of hydrogen atoms to metal atoms between 0.1 and 4, more preferably between 1 and 2.
6. Neutron shielding according to any preceding claim, wherein each absorption layer comprises an alloy of tungsten metal and tungsten boride and/or carbide.
7. Neutron shielding according to any preceding claim, wherein the total thickness of the absorption layers is at least 75% of the total combined thickness of the absorption layers and the moderating layers, more preferably between 80% and 95%.
8. Neutron shielding according to any preceding claim, wherein an outer absorption layer has a thickness which is between 30% and 90% of the total combined thickness of the absorption layers and the moderating layers, more preferably between 40% and 80%, the shielding being configured such that the outer absorption layer faces a neutron source.

9. Neutron shielding according to claim 8, wherein a further absorption layer which is not the outer absorption layer has a thickness which is at least 10% of the total combined thickness of the absorption layers and the moderating layers .
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10. Neutron shielding according to any preceding claim, and comprising coolant channels located between the absorption layers and the moderating layers.
11. Neutron shielding according to any preceding claim, and comprising coolant channels integrated within one or more of the absorption layers and/or the moderating layers.
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12. Neutron shielding comprising a metal hydride, the metal hydride comprising a neutron absorbing element which:
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- has an average neutron absorption cross section which is greater than 0.1 barns at a neutron energy range between 0.02 and 0.03 eV; and
- has a solid solubility of at least 1 mol% with all other metals in the alloy.
13. Neutron shielding according to claim 12, wherein the metal hydride comprises one or more of the metals from groups 4, 5 and 6 from the periodic table and/or yttrium, beryllium, gadolinium, or uranium.
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14. Neutron shielding according to claim 13, wherein the neutron absorbing element is one of:
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- hafnium;
- tungsten;
- boron;
- dysprosium; or
- gadolinium;.
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15. An assembly comprising neutron shielding according to claim 10 or 11, and a coolant source connected to the coolant channels, wherein the coolant source is configured to maintain the neutron shielding at a temperature below a decomposition temperature of the metal hydride.
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16. A tokamak nuclear fusion reactor comprising:
a toroidal plasma chamber;
a plasma confinement system arranged to generate a magnetic field for confining
a plasma in an interior of the plasma chamber;
- 5 neutron shielding according to any of claims 1 to 14 arranged between the interior
of the toroidal plasma chamber and the plasma confinement system.
17. A tokamak nuclear fusion reactor according to claim 16, wherein the neutron
shielding is neutron shielding according to claim 10 or 11, and comprising a coolant
source connected to the coolant channels, wherein the coolant source is configured to
10 maintain the neutron shielding at a temperature below a decomposition temperature of
the metal hydride.