9. A catalyst comprising:

an aluminide-containing substrate;

a dense and substantially defect-free alumina layer disposed on the aluminide-containing substrate; and

a catalyst material directly disposed on the thermally-grown alumina layer.

10. The catalyst of claim 9 wherein the dense and substantially defect-free alumina layer comprises a thermally-grown alumina layer.

11. A process for converting ethane to ethylene, comprising:

contacting ethane and oxygen in a reaction microchannel;

wherein the reaction microchannel comprises a catalyst coated on a substrate;

wherein (a) at least 50% of the ethane entering the reaction microchannel is converted to products and the selectivity to ethene is at least 85%; or

(b) at least 70% of the ethane entering the reaction microchannel is converted to products and the selectivity to ethene is at least 80%; and

wherein the levels of selectivity and conversion are based on a single pass through the reaction microchannel.

12. The process of claim 11 wherein the substrate comprises a wall of the reaction microchannel, and further comprising removing heat from the reaction microchannel into an adjacent heat exchanger.

13. The process of claim 12 wherein at least about 80% of the ethane entering the reaction microchannel is converted to products.

14. The process of claim 12 wherein the adjacent heat exchanger comprises a microchannel heat exchanger.

15. The process of claim 1 1 wherein the selectivity to ethene is in the range of 84% to about 93%.

16. The process of claim 12 wherein the reaction microchannel comprises a metallic microchannel wall;

wherein the metallic microchannel wall is coated with an aluminide layer;

wherein the aluminide layer is coated with a dense and substantially defect-free alumina layer surface layer; and

wherein a catalytic material is directly disposed on the surface layer.

17. The process of claim 17 wherein the dense and substantially defect-free alumina layer comprises a thermally-grown alumina layer.

18. A process for oxidative dehydrogenation, comprising:

passing an alkane over a fixed catalyst comprising Pt and Sn in a Pt/Sn atomic ratio in the range of 1 to 4 directly disposed on a thermally-grown oxide layer.

19. The method of claim 18 wherein the catalyst comprises Pt and Sn in a Pt/Sn atomic ratio in the range of about 2.3 to about 2.5.

20. The method of claim 18 wherein the fixed catalyst consists essentially of Pt and Sn on a dense and substantially defect-free alumina layer.

* * * * *