Among the wide range of intermetallic compounds, aluminides and especially iron, titanium and nickel aluminides have been the most widely regarded engineering materials. One of the important intermetallic compounds that is expected to be more applicable, due to low cost of raw materials, is the FeAl compound. Despite many desirable properties, the FeAl composition, like other intermetallic compounds, has several limitations, especially low temperature ductility and low creep strength at high temperature. Adding alloying elements, controlling the atmosphere, reducing grain size, controlling microstructures, controlling defects and impurities, adding second phase such as oxides and thermomechanical treatment have been introduced to increase ductility of FeAl. The aim of the present study was to improve ductility of FeAl based intermetallic compounds. In the first step, synthesized of FeAl, (Fe,Cr) Al intermetallic compounds and (Fe,Cr) Al-$Al_{٢}O_{٣}$ nanocomposites was performed by mechanical alloying (MA) method. For this purpose, iron, aluminum, chromium, iron oxide (or chromium oxide) powders were mixed with stoichiometric composition to produce FeAl, (Fe,Cr)Al and (Fe,Cr)Al-$Al_{٢}O_{٣}$ powders by mechanical alloying. The results showed that FeAl compound is formed after ٣٠ h of MA time and by increasing the milling time to ١٠٠ h the grain size reached to ٦٠ nm. In the next step, the (Fe, Cr) Al intermetallic composition was synthesized by stoichiometry of $Fe_{٤٠}Cr_{١٠}Al_{٥٠}$ after ٣٠ h. In the third step, (Fe,Cr)Al metal matrix nanocomposite containing $Al_{٢}O_{٣}$ reinforcement phase was fabricated. For this purpose, two different approuches, reduction of chromite ($Cr_{٢}O_{٣}$) and hematite ($Fe_{٢}O_{٣}$) by Al were used. During the mechanical alloying of the Fe-Al-$Cr_{٢}O_{٣}$ powder mixture, aluminum and chromium oxide did not react and the alumina phase did not form, therefore the reduction of hematite was used. In Cr-Al-$Fe_{٢}O_{٣}$ system, the heat generated by Al-$Fe_{٢}O_{٣}$ reaction lead to formation of Al (Fe, Cr) phase with grain size about ٢٠ nm and $Al_{٢}O_{٣}$ crystalline particles with grain size of ١٨ nm. Then the prepared powders were sintered by hot pressing at ١٦٠٠°C, ٥٫٥ GPa for ١٥ min. The properties of the bulk compound including the microstructure, mechanical properties, oxidation resistance and high temperature wear behavior were evaluated. The results illustrated that the presence of Cr and $Al_{٢}O_{٣}$ nanoparticles improved the FeAl properties. Also, transmission electron microscopy (TEM) studies showed that $Al_{٢}O_{٣}$ particles retained their nano dimensions and did not exhibit significant growth. The results of the nanoindentation test indicated a high hardness of ٢١GPa, a Youngs modulus of ٦٠٥ GPa and a fracture toughness of ١٩$MPa.m^{١/٢}$ for (Fe, Cr) Al-١٠٪ vol$Al_{٢}O_{٣}$ nanocomposite. Also the study of wear behavior at ٤٠٠ °C showed a high wear resistance of this compound. Oxidation behavior of compounds accorded with the parabolic law. The (Fe,Cr)Al compound had the lowest weight gain among the other compounds, revealing the protection role of Cr. To improve surfaceproperties the bulk samples were subjected to the plasma oxidation process to create a thin oxide layer on the surface. The results of X-ray analysis (XRD) and electron backscatter diffraction analysis (EBSD) confirmed the formation of $Al_{٢}O_{٣}$. Creating a thin oxide layer on the surface while improving the mechanical properties and wear resistance can prevent atmospheric reaction with the surface, leading to improved ductility and increased fracture toughness. Surface roughness and topography were investigated by atomic force microscopy (AFM) after plasma oxidation. Transmission electron microscopy images showed that the plasma oxidation surface layer had a thickness of about