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An atmospheric pressure dielectric barrier discharge (DBD) in Ar/NH$_3$ (0.1 - 10%) mixtures with a parallel plate electrode geometry was studied. The plasma was investigated by emission and absorption spectroscopy in the UV spectral range. Discharge current and voltage were measured as well. UV absorption spectroscopy was also employed for the detection of stable products in the exhaust gas. To clarify the different processes for ammonia decomposition, N$_2$(2 - 10%) was added to the plasma. Modeling of the chemical kinetics in an Ar/NH$_3$ plasma was performed as well. The dominant stable products of an atmospheric pressure Ar/NH$_3$ DBD are H$_2$, N$_2$ and N$_2$H$_4$. The hydrazine (N$_2$H$_4$) concentration in the plasma and in the exhaust gases at various ammonia concentrations and different discharge powers was measured. Thermal N$_2$H$_4$ decomposition into NH$_2$ radicals may be used for NOx reduction processes.