INFLUENCE OF HYDROSTATIC PRESSURE ON MAGNETIC PROPERTIES OF (Sr,La)(Ru,A)O_3 FOR A = Cr, Mn

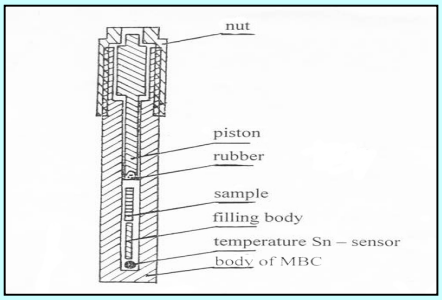
J. PIĘTOSA [1], A. WIŚNIEWSKI [1], R. PUŹNIAK [1], S. KOLESNIK [2], M. MAJJIGA [2], B. DABROWSKI [2]

[1] *Institute of Physics, Polish Academy of Sciences, Aleja Lotnikow 32/46, 02-668 Warsaw, Poland*
[2] *Physics Department, Northern Illinois University, De Kalb, IL 60115, USA*

$SrRuO_3$ is known as the only 4d transition metal oxide that presents ferromagnetic (FM) properties.
Strong Ru_{t2g}-O_{2p} hybridisation leads to an itinerant character of ferromagnetism in this compound.
Different substitutions in $SrRuO_3$ result in remarkable changes of magnetic properties leading to a decrease ($La_{0.2}Sr_{0.8}RuO_3$, $SrRu_{0.9}Mn_{0.1}O_3$) and to an increase ($SrRu_{0.9}Cr_{0.1}O_3$) of Curie temperature.

The external pressure is a useful tool to tune the magnetism in these oxides due to its **influence** on **structural distortion** and consequently on **Ru–O hybridisation**.

The pressure cell used in magnetic measurements



Weakening of FM interactions with increasing pressure results from an attenuation of Ru-O hybridisation. The charge carriers become more localised and various physical effects may appear. In the investigated samples it was found:
- $La_{0.2}Sr_{0.8}RuO_3$ - antiferromagnetic coupling in Ru-O-Ru array
- $SrRu_{0.9}Cr_{0.1}O_3$ - lack of contribution to antiferromagnetism due to coupling between Ru and Cr.
- $SrRu_{0.9}Mn_{0.1}O_3$ - strong hole-doping dependence of magnetism
- $SrRuO_3$ - domination of strain effects

The $T_C(P)$ decreases for all of the studied samples.
The $M_0(P)$ remains unchanged for most of the samples, except for the $La_{0.2}Sr_{0.8}RuO_3$ sample.
The weakening of ferromagnetic interactions with increasing pressure was mainly related to the modulation of the Ru–O hybridisation by the change of structural distortion.

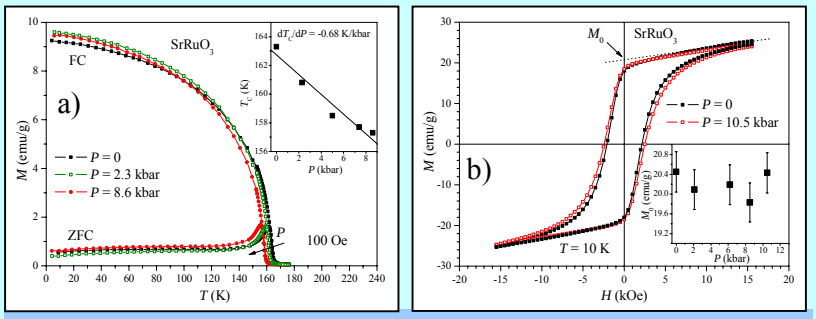


Fig.1. (a) Temperature dependence of M_{ZFC} and M_{FC} for $SrRuO_3$ measured at 100 Oe. Inset: pressure dependence of the Curie temperature. (b) Hysteresis loops for $SrRuO_3$ at T=10 K. Inset: pressure dependence of spontaneous magnetisation M_0.

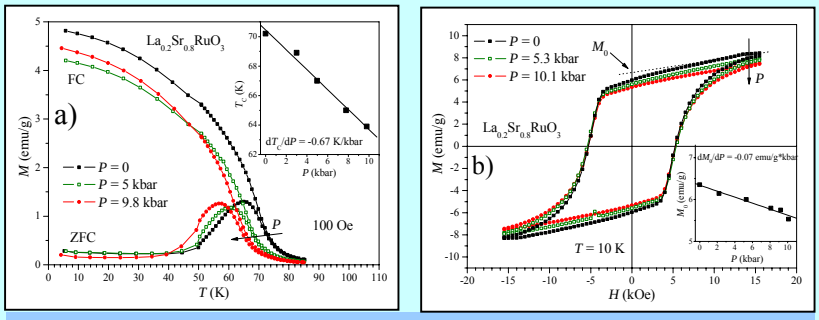


Fig.2. (a) Temperature dependence of M_{ZFC} and M_{FC} for $La_{0.2}Sr_{0.8}RuO_3$ measured at 100 Oe. Inset: pressure dependence of T_C. (b) External field dependence on magnetisation of $La_{0.2}Sr_{0.8}RuO_3$ at T=10K. Inset: pressure dependence of spontaneous magnetisation M_0.

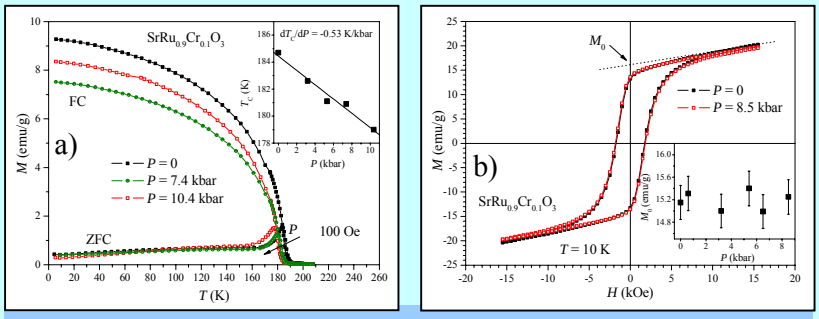


Fig.3. (a) Temperature dependence of M_{ZFC} and M_{FC} for $SrRu_{0.9}Cr_{0.1}O_3$ measured at 100 Oe. Inset: pressure dependence of T_C. (b) Hysteresis loops of the magnetisation of $SrRu_{0.9}Cr_{0.1}O_3$ at T=10K. Inset: pressure dependence of spontaneous magnetisation M_0.

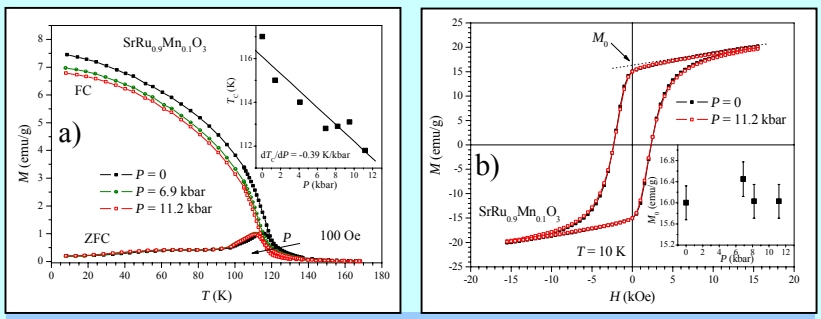


Fig.4. (a) Temperature dependence of M_{ZFC} and M_{FC} for $SrRu_{0.9}Mn_{0.1}O_3$ measured at 100 Oe. Inset: pressure dependence of T_C. (b) Hysteresis loops of the magnetisation of $SrRu_{0.9}Mn_{0.1}O_3$ at T=10K. Inset: pressure dependence of spontaneous magnetisation M_0.