CHAPTER VI

SUMMARY & FUTURE WORK

The work in this thesis is the basis of the preparatory work for two research projects supported by the Office of Science and Technology Development Board (STDB) and for a Program for the Research and Development of "High Technology" Ceramics being conducted in the Department of Physics, Faculty of Science, Mahidol University. The titles of the two STDB funded projects are:

MODIFICATION OF THE ANNEALING PROCESSES IN THE FABRICATION OF "HIGH TECHNOLOGY" FERRITES AND YIG GARNETS TO ACHIEVE OPTIMAL MAGNETIC PROPERTIES FOR USE IN MICROWAVE DEVICE.

and

DEVELOPMENT OF NICKEL-ZINC AND OTHER "HIGH TECHNOLOGY" FERRITES FOR USE IN UHF (400 & 800 MHZ) TELECOMMUNICATION EQUIPMENT.

The work done in this thesis provided some very useful information needed to carry out the above projects. By examining the X-ray patterns of YIG pellets prefired at 1380^{o} C for different time periods, it was found that the solid state reaction of the Fe_2O_3 and Y_2O_3 was completed in less than two hours. The changes in the positions of the peaks in the X-ray patterns of YIG specimens sintered for different time periods also point to the

fact that one has to take this into account when producing YIG's for commerical use. While not a part of this work, it was also seen that sizes of the grains formed during the sintering processes depend on the particle sizes of the reacted oxides, on the sintering temperature and the sintering time. The experience gained in this study will be useful in carrying out further fabrication of ceramic ferrites.

The Mössbauer study confirms the results obtained by others. The results obtained in this study will be used in future studies on the effects of aluminum substitution into the YIG. The resulting compound, YAG's, are very important for microwave applications. Preliminary Mössbauer studies of $Y_3Al_xFe_{5-x}O_{12}$ ceramics (fabricated during work on this thesis) indicate that the magnetic structure collapses before the crystal structure. The Mössbauer spectra for $Y_3Al_{.5}Fe_{4.5}O_{12}$ (Figure 6.1) still shows the presense of three sextet patterns (with small splittings of the peaks). The spectra for $Y_3Al_{1.5}Fe_{3.5}O_{12}$ (Figure 6.2) is completely different. One of the sextets appear to have callapsed into a quadrupole doublet or a single Lorentzian line. Looking at the X-ray diffraction patterns of these two YAG's (Figures 6.3 and 6.4), we see the structures are essentially the same as that of YIG (see Figure 3.6). Work is in progress to see at exactly what concentration does the magnetic structure collapse.

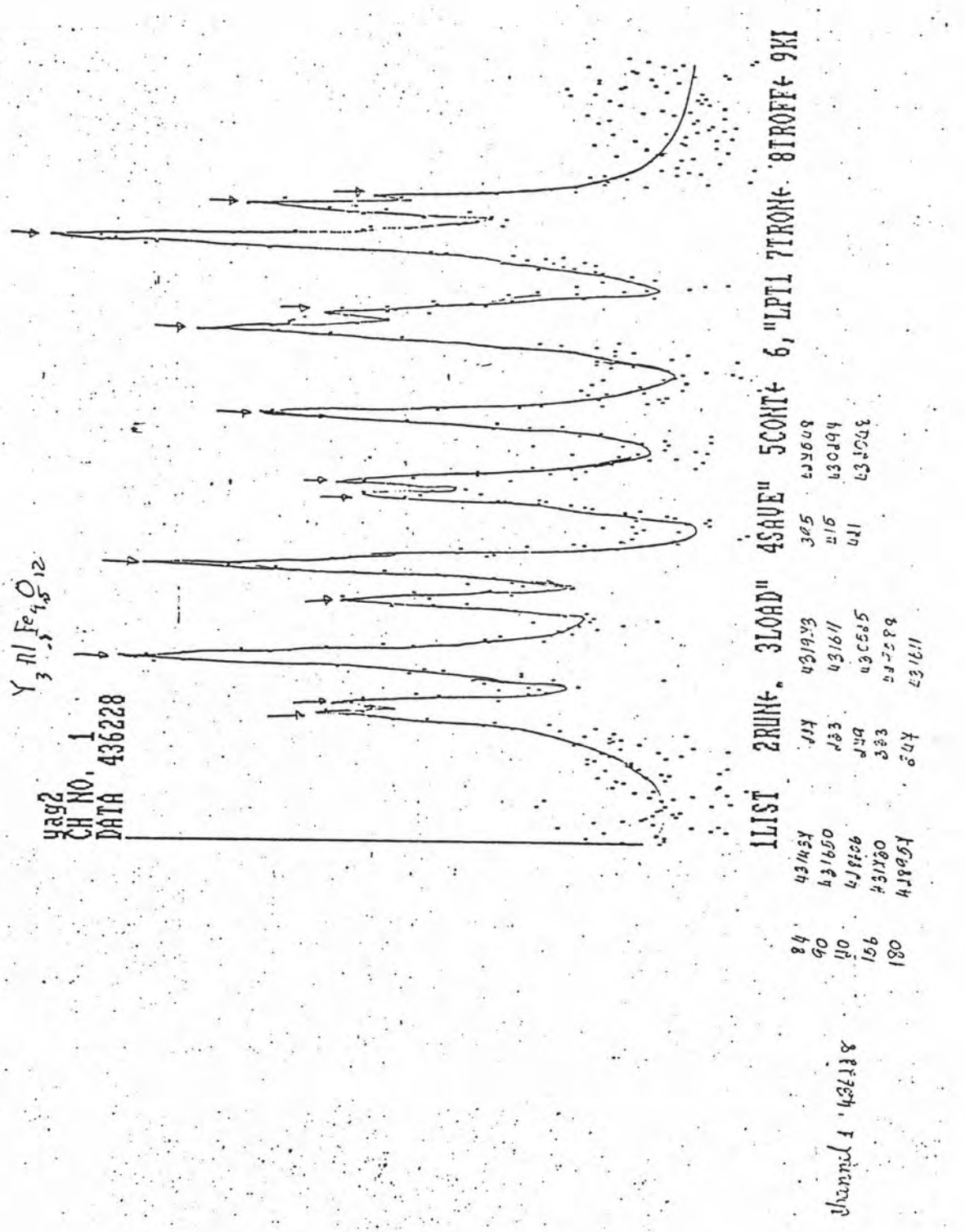

Figure 6.1 The Mössbauer spectra for $Y_3Al_{.5}Fe_{4.5}O_{12}$.

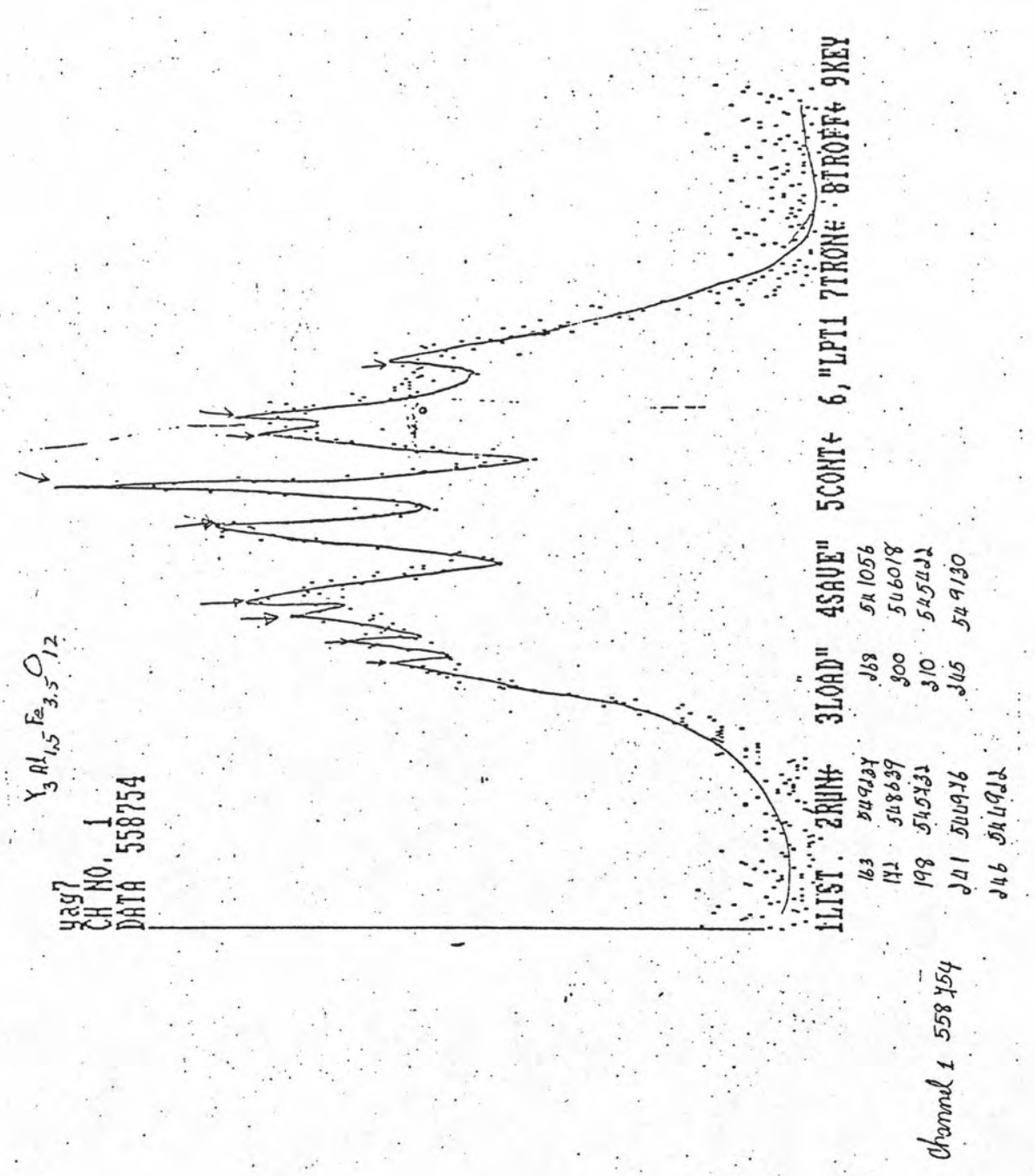

Figure 6.2 The Mössbauer spectra for $Y_3Al_{1.5}Fe_{3.5}O_{12}$.

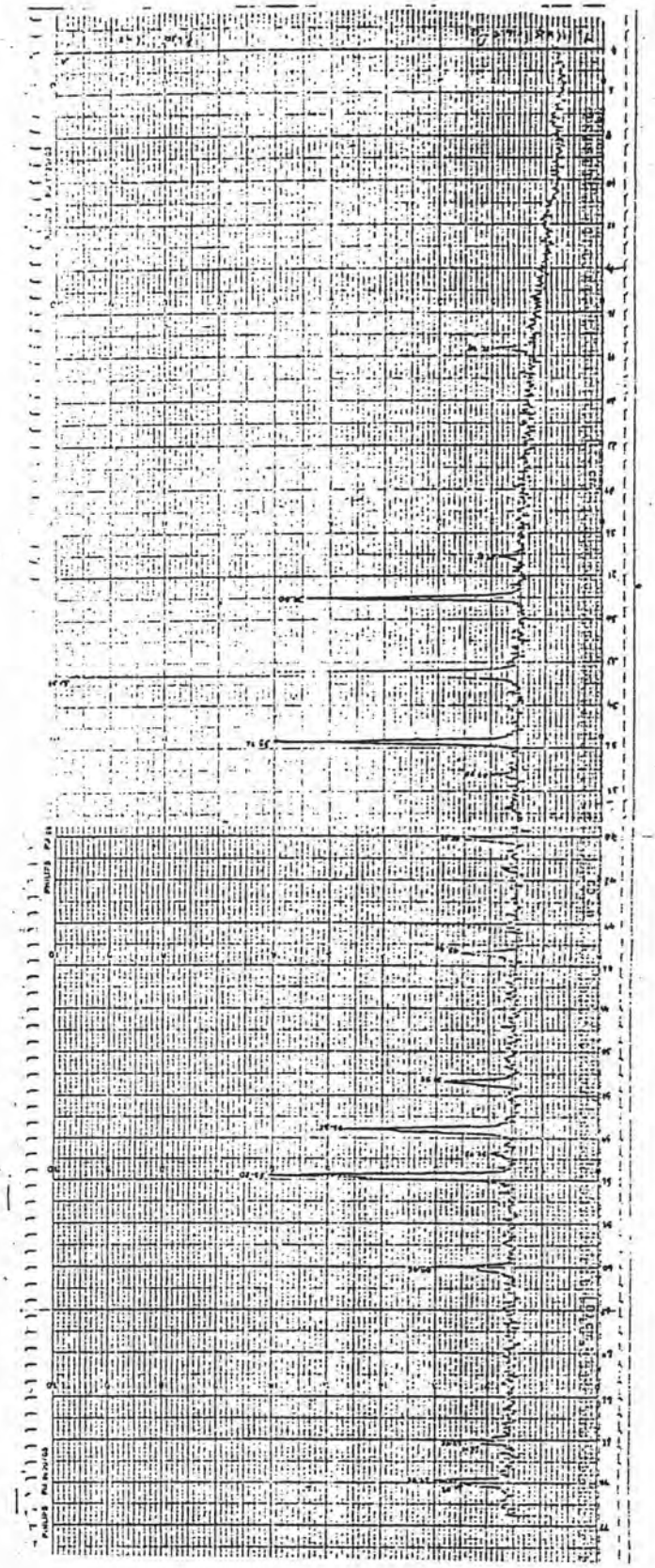

Figure 6.3 The X-ray diffraction pattern for $Y_3Al_{.5}Fe_{4.5}O_{12}$.

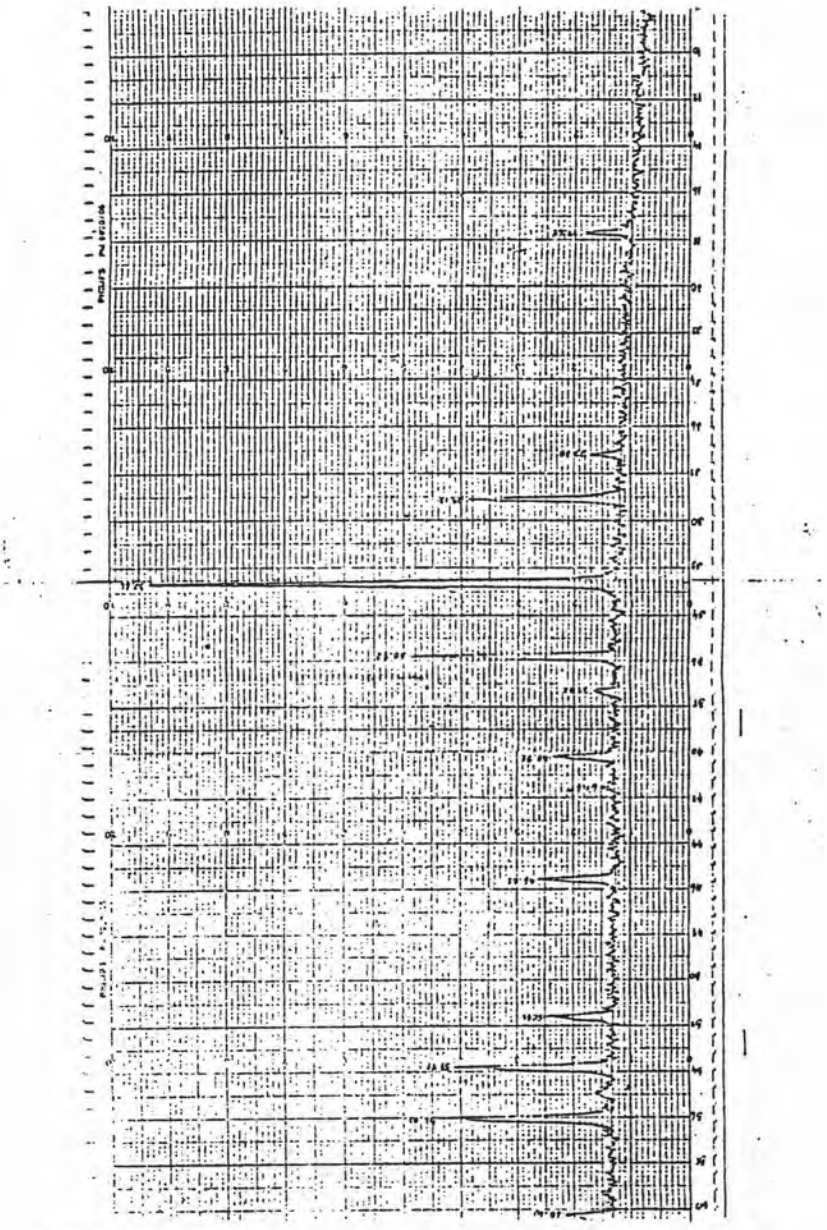

Figure 6.4 The X-ray diffraction pattern for $Y_3Al_{1.5}Fe_{3.5}O_{12}$.