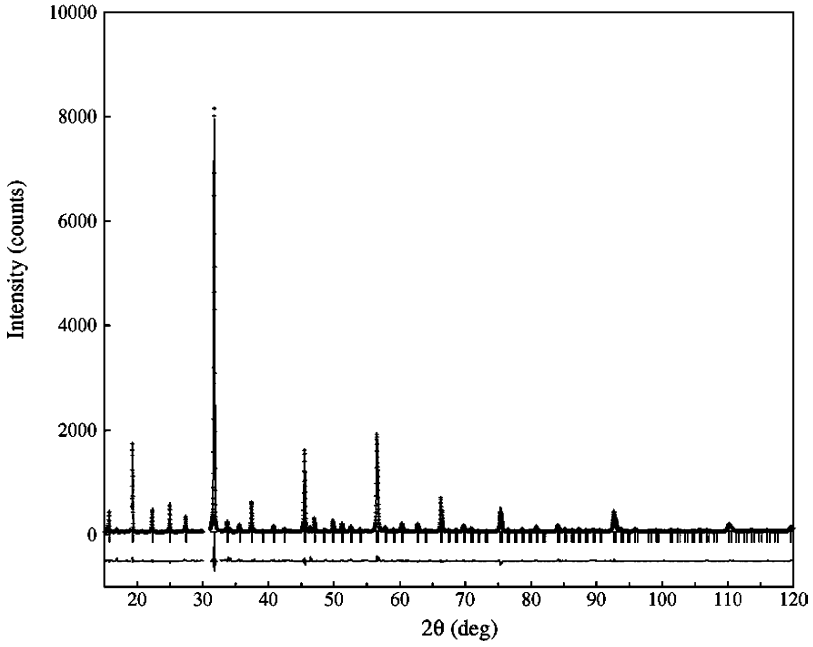

Fig. 4. Observed (cross) and calculated (solid line) X-ray diffraction patterns of $Sr_8CaRe_3Cu_4O_{24}$. Tick marks indicate the positions of allowed Bragg reflections. The difference line, observed minus calculated, is located at the bottom of the figure.

Table 1
Structural parameters of $Sr_8CaRe_3Cu_4O_{24}$

Atom	Site	x	y	z	B (Å)^2
Ca	1*a*	0	0	0	0.278(4)
Cu1	1*b*	1/2	1/2	1/2	0.584(7)
Cu2	3*c*	0	1/2	1/2	0.85(1)
Re	3*d*	1/2	0	0	0.656(8)
Sr	8*g*	0.26994(9)	0.26994	0.26994	1.10(1)
O1	6*e*	0.271(2)	0	0	9.5(1)
O2	6*f*	0.252(1)	1/2	1/2	2.91(4)
O3	12*h*	0.234(1)	1/2	1/2	7.01(9)

$Sr_8CaRe_3Cu_4O_{24}$ space group: *Pm*-3*m*
Lattice parameters: $a = 7.971(8)$ Å
Reliability factors: $R_{wp} = 6.96$, $R_I = 5.64$

Occupation factor is unity for the all atoms.

Table 2
Selected bond lengths (Å) in $Sr_8CaRe_3Cu_4O_{24}$

Ca–O1	2.16(2)	Re–O1	1.82(2)
Cu1–O2	1.974(8)	Re–O3	1.86(1)
Cu2–O2	2.012(8)	Sr–O1	3.043(3)
Cu2–O3	2.12(1)	Sr–O2	2.597(3)
		Sr–O3	2.842(3)

it will be helpful for further consideration of the structure.

3.2. Magnetic properties

Magnetic properties were mainly measured for the Ca-containing sample with the nominal composition of $Sr(Ca_{0.175}Re_{0.325}Cu_{0.5})O_{3.15}$ which was ferromagnetic at room temperature. To calculate molar magnetic quantity, we assumed $Sr_8CaRe_3Cu_4O_{24}$ (stoichiometric composition) as the formula unit. As stated above, there is some uncertainty on the composition of the phase. However, the difference between the molecular weights calculated for the nominal composition and for the stoichiometric one is only ca. ~3% and does not cause serious error. A magnetization curve measured at 5 K is given in Fig. 5 where typical ferromagnetic behavior is seen. Magnetization was saturated above ~5000 Oe and a small hysteresis loop was observed. In order to obtain variation of the spontaneous magnetization M_s as a function of temperature, magnetization curves were measured at various temperatures as shown in Fig. 6. From the extrapolation of high-field data to $H = 0$, M_s was obtained and is plotted against temperature in Fig. 7. In Fig. 7, a small anomaly is seen near 120 K. However, we did not observe the corresponding anomaly when the magnetization was measured with decreasing temperature. The anomaly is probably due to some experimental problem.

The spontaneous magnetization at $T = 0$, M_0, is estimated to be ~0.95 μ_B/f.u. from this figure. High-temperature magnetization data measured at 1 kOe by VSM are also shown in Fig. 7 which indicate T_c as high as 440 K. So far, a very limited number of cuprate ferromagnets have been known; rare examples are $La_4Ba_2Cu_2O_{10}$ ($T_c = 5$ K) [9], K_2CuF_4 ($T_c = 6.5$ K) [10] and $SeCuO_3$ ($T_c = 26$ K) [11], etc. in which Cu–O–Cu (or Cu–F–Cu) bond angles are far less than 180° with a ferromagnetic interaction between the Cu moments. The