RESEARCH ON PROPERTIES OF CuCoTa CONTACT MATERIAL FOR VACUUM CIRCUIT BREAKER

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ABSTRACT Manufacturing and experimental test of CuCoTa contact material first trial-produced in china are introduced. The result of test show that the vacuum arc of vacuum interrupter using CuCo20Ta contact material arcs with lower energy, the arc voltage is lower, the interrupting capacity of CuCo20Ta is 24% more than that of CuCr50 contact material at same conditions. The gas content of CuCoTa contact material is lower. Reject garbage formatting in manufacturing and machine-shaping the CuCoTa contact material can be reused by melting back.

Key words: CuCoTa; contact material; vacuum interrupter

1. INTRODUCTION

The contact material is a critical factor that decides interrupting capability for vacuum interrupters. In order to improve the performance of contact material, many experimental attempts are devoted primarily to developing contact material, such as, changing the elements content and composition[1-4], improving and applying new process methods[3-7]. To improve interrupting capability of vacuum interrupter, CuCoTa contact material is studied in this paper.

2. THE MATERIALS PREPARATION

1) CuCoTa contact material

(1) Raw materials

Co powder, Ta powder and vacuum Cu

(2) Preparation process

Vacuum smelting and casting

(3) The elements content (wt%)

Ta: 5%

Co: 5-20%

Cu: 75-90%

2) CuCr50 contact material

Prepared by conventional process method.

3. EXPERIMENTAL RESULTS

1) Microstructure of the CuCoTa

Microstructure of the CuCo20Ta is shown is Fig.1.

Fig.1 microstructure of CuCo20Ta

2) The gas content

Tab.1 the gas content of contact material

Material	$O/10^{-6}$	$N/10^{-6}$
CuCr50	380	40
CuCo20Ta	10	20

3) Hardness and electrical conductivity

Tab.2 hardness of the CuCoTa materials

Co content	5%	15%	18%	20%
Hardness/HB	71	89	93	102

Tab.3 conductivity of the CuCoTa

Co content	15%	18%	20%
Conductivity $MS \cdot m^{-1}$	13	12	11

With the increasing of Co content, hardness of CuCoTa contact material increase, while the electrical conductivity of CuCoTa material

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decrease.

4) Density of the material

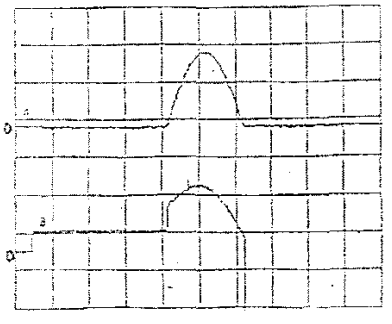
CuCr50 : 7.9 g/cm^{-3}

CuCo20Ta: 8.9 g/cm^{-3}

5) Interrupting current capability

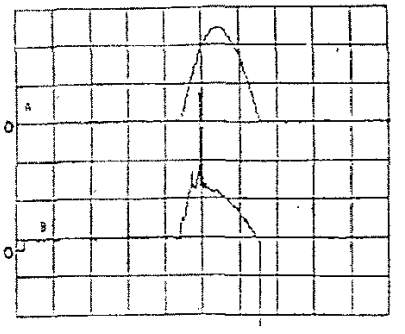
To check the interrupting current capability of CuCoTa and CuCr50 contact materials, the vacuum interrupters with same structures and dimensions (cup-type axial magnetic field contact structure, contact diameter is 40mm, the gap length between two contacts is 10mm) are manufactured applying CuCo20Ta and CuCr50 contact materials. A Weil synthetic circuit is used to carry out synthetic test on the vacuum interrupters at the same conditions. The test results show that the interrupting ability of the vacuum interrupter applying CuCo20Ta material is 18 kA (rms), while the interrupting ability of the vacuum interrupter applying CuCr50 material is 14.5 kA (rms), the interrupting capacity of CuCo20Ta5 is 24% more than that of CuCr50 contact material at same conditions.

The oscillograms of interrupting short current 18 kA(rms) for CuCoTa vacuum interrupter is shown in Fig.2, The oscillograms of interrupting short current 14.5 kA(rms) for CuCr50 vacuum interrupter is shown in Fig.3.



A-arc current,9 kA/div; B-arc voltage, 30V/div; time-5ms/div

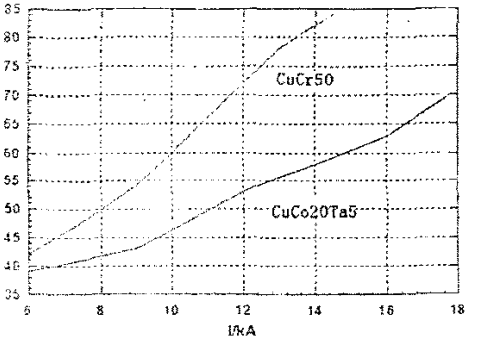
Fig.2 oscillgram of interrupting current and arc voltage

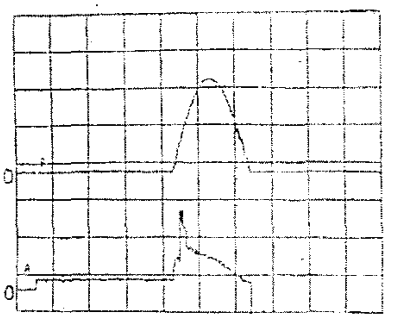


A-arc current, 6 kA/div; B-arc voltage, 60V/div; time-5ms/div

Fig.3 oscillgram of interrupting current and arc voltage

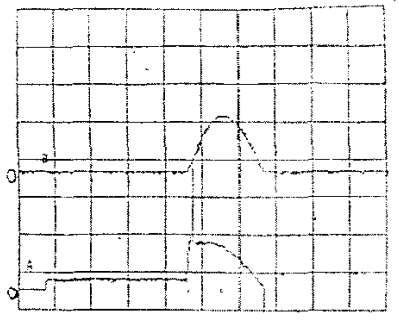
The relation between arc voltage and interrupting current for CuCoTa and CuCr vacuum interrupter is shown in Fig.4, the vacuum arc of CuCoTa vacuum interrupter arcs with lower energy, and the arc voltage is lower.





B-arc current, 6 kA/div; A-arc voltage, 60V/div; time-5ms/div

Fig.5 oscillgram of interrupting current and arc voltage



B-arc current,15kA/div; A-arc voltage, 60V/div; time-5ms/div

Fig.6 oscillgram of interrupting current and arc voltage

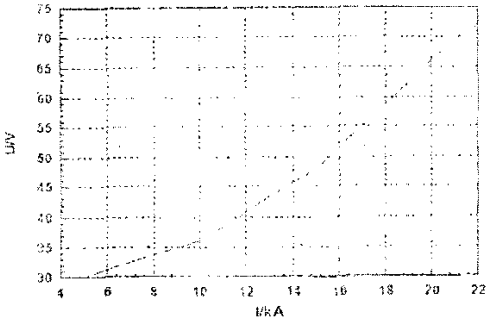


Fig.7 relation between arc voltage and interrupting current

6) Voltage withstand property

CuCo20Ta material's withstand voltage properties after and before interrupting current is not lower than that of CuCr50 prepared by conventional process methods.

4. SUMMARY

Manufacturing and experimental test of CuCoTa contact material first trial-produced in china are introduced.

The result of test show that the vacuum arc of vacuum interrupter using CuCo20Ta contact material arcs with lower energy, the arc voltage is lower, the interrupting capacity of CuCo20Ta is 24% more than that of CuCr50 contact material at same conditions. The gas content of CuCoTa contact material is lower.

Reject garbage formatting in manufacturing and machine-shaping the CuCoTa contact material can be reused by melting back.

5. REFERENCES

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