Study of the sinterability of a recycled tungsten carbide powder

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According to a 2011 report, The EU Commission has classed 14 elements, including cobalt, as “critical raw materials” (CRMs). Cobalt suffers from its large use in Li-ions batteries for electrical cars: in 2015, 50% of the cobalt demand was used for batteries.

Another issue with the cobalt is the fluctuation of its price due to different factors:
- More than 50% of the world resources are located in DRC and Zambia, two politically unstable countries.
- Co price depends on the copper and nickel mining since its extraction comes by-products of Cu and Ni.

Necessity to recycle cobalt! However extracting cobalt from WC-Co hardmetals is not easy...
Alternative: recycling WC and Co together.

Preliminary results

Only 65% of full density was reached
To increase the sinterability:
- Sinter in higher temperature conditions.
- Ball mill the powder to break the agglomerates
- Use unconventional sintering technologies.

Experiments

Vacuum sintering
Vacuum sintering
6h dry ball milling
300 rpm
Balls/powder: 4/1

SPS on the recycled powder (as-received and ball milled) – 50 MPa; 5 min; 150°C/min

References
- P. Alves Dias and al., “Cobalt- demand-supply balances in the transition to electric mobility”, JRC Science for Policy Report, 2018

Conclusion
Higher temperature: not sufficient to reach a full dense sample
Ball milling: sinterability ↑ and sintering temperature ↓
SPS: sinterability ↑ and hardness ↑