**Supplementary Materials**

**Wear behavior of Al0.6CoCrFeNi high-entropy alloy: Effect of**

**environments**

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**Appendix**. **Calculations of the frictional heat**

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Fig. S1. The model of the contact-pressure distribution

Figure S1 schematically displays a model of the contact-pressure distribution, an elliptical contact area resulting from ball loading force. Assuming that the long half axis of the ellipse is *a*, the short half axis is *b,* and the contact center is used as the origin to establish the rectangular coordinate system, the contact pressure is determined by the contact theory1, 2 :

** (1)

The contact pressure reaches its maximum (), when the contact point is at the origin (i.e., x=0 and y=0), which also corresponds to the peak friction force. An assumption is made that the contact surface is approximately a circular shape, and is the time required to slip through the circle at a speed of *v* (*v* is a fixed value). *F* is substituted by, then:

 (2)

where *A* is the contact area of an infinitely small area. Defined as:

Equation 4 can be modified into:

 (3)

whereis the mean friction coefficient between  and , and  represents the maximum heat generation of an infinitely-small area. The heat flux, *q*, can be deduced by the definition:3-7. If the effect of the dissipation of the frictional heat in air is ignored, that is, all the frictional heat is absorbed by the ball and the materials as *q1* and *q2*, respectively, it is obtained 8:



 (4)

where is the division of the frictional heat coefficient, and  are the thermal conductivity, mass density, and specific heat capacity, respectively. It is worth noting that the functions, and reflect the dependence of on the contact parameters. Thus, the characteristic equation about  is given by ref.8,

 (5)

Where is the thermal diffusivity, H is the hardness of the material, ** is the first type of Bessel functions, and its shape is similar to the attenuation of the trigonometric function. At a low speed, . Therefore, the effect of **on  can be ignored in practical applications. Hence, the characteristic function  may be rewritten as: .

Combining Eqs.3, 4, and 5, the heat flux in the local area, *q2*, can be calculated:

 (6)

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