References

1. Voeikov V. L. Physico-chemical and physiological aspects of the reaction of the blood sedimentation / V. L. Voeykov // USP. Physiology. Sciences., 1998. – Vol. 29, No. 4.

2. Popova E. V., Aristov A. A. a Device for estimating parameters of aggregation of erythrocytes // XIV international scientific-practical conference "Modern technique and technologies" . – Tomsk, 2008. – vol. 1. – S. 226-228.

3. The method of determining the dynamics of sedimentation of blood cells: Pat. 2379687 Russian Federation: IPC G01N33/49, Publ.20.01.2010

4. A device for evaluating the physical properties of biological fluids: Pat. 47526 Russian Federation: IPC G01N33/49, Publ. 27.08.05

FRICTION WELDING

Nikiforov D.S., Raspaev A.A.
Tomsk Polytechnic University, Tomsk
Scientific supervisor M.V. Kuimova, PhD in Methods of TFL,
Associate Professor of TPU

Welding is a technological process of making permanent joints [1]. Friction welding refers to welding pressure. The welded joint is formed in the plastic state under the influence of heat due to the friction of surfaces of the welded parts. The simplest and most common scheme of this process is shown in Image 1. The two parts to be welded are placed coaxially in the force clamps of the machine. One of them is stationary and another rotates around their common axis. The pressure is put on one part and causes the frictional forces. The work done against the forces of friction is converted into heat which heats the adjacent thin metal layers to the temperatures needed for a welded joint. During the friction, the ductile metal is squeezed out in radial directions caused by the axial and tangential forces. The upset metal (weld flash) has the form of a double ring located on both sides of the interference surface (Image 2) [2].

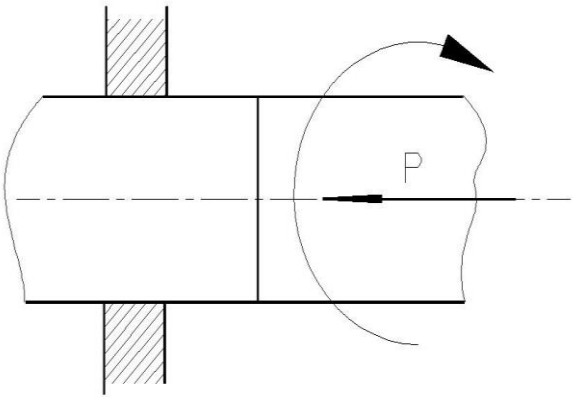

Image 1. The simplest scheme for friction welding.

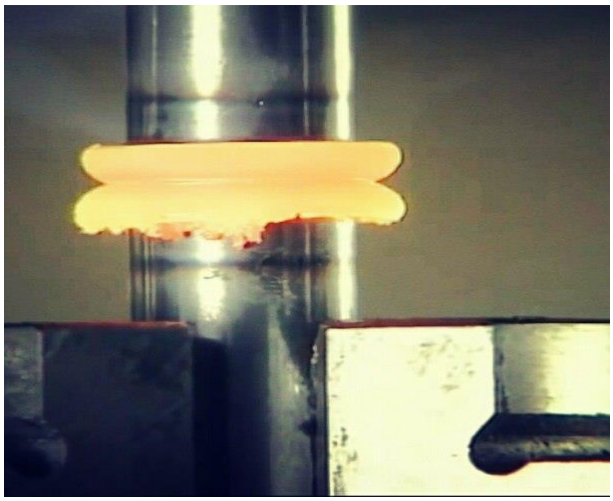

Image 2. Characteristic form of friction welding.

Heating is stopped by the rapid termination of the relative rotation [3]. The basic parameters, required for friction welding, are presented in Table 1.

The diameter of the work-piece, mm.	**The main parameters of the process**					**Additional data**	
	Rotation frequency r/min	Axial force, kgf		Time, sec.		Consumed power, kW	Machine time of the process, sec.
		Heat	Hammering	Heat	Hammering		
20	400	1500	3000	5–6	1.5	4	6.5
50	1000	10000	20000	20	2.0	25	22

Table 1. Basic parameters of friction welding.

Friction welding has the following advantages:

1. high performance due to the minor volume of the layer of the heated metal;
2. lower energy and power consumption (5–10 times less compared to resistance welding);
3. high quality of the weld joint;
4. possibility to weld metals and alloys with different physical, mechanical and thermal characteristics (Fe+Al; Fe+Cu; Ti+Al; Plb+LiO);
5. lack of ultraviolet emission of harmful gas releases and hot metal splashes [4].

Type of welding	**The diameter of the workpiece, mm.**	**Specific electric power, kW**	**Time of the process, sec.**
Friction	50	25	22
Resistance	50	150	29

Table 2. Types of welding.

Friction welding is not a universal process. It has the following disadvantages:

1. The process can not be mobile due to the inconvenience of the equipment;
2. It can be used to joint parts where one part is a body of rotation and its axis coincides with the axis of rotation;
3. It has specific peculiarities of the joint.

Friction welding is used to manufacture cutting tools in the production of composite welded-forged or welded-cast parts. It is essential in connection of difficult to weld materials or materials which can not be jointed by other types of welding [5].

Friction welding is a cost-effective process. The energy consumption is 7–40 times less than in resistance welding. Friction welding enables to weld dissimilar metals (aluminum with copper, aluminum with steel, copper with steel, etc.) and effective for welding of metal-cutting tools of carbon and high-speed steel. Nowadays, friction welding is one of the most rapidly developing technological processes, particularly in countries with a high level of industrial development.

References

1. Friction welding (Inertial friction welding, Orbital friction welding). http://www.autowelding.ru/index/0-60 (accessed 27 April, 2016).
2. Friction-welding. http://pandia.ru/text/77/194/29096.php (accessed 27 April, 2016).
3. Friction welding http://www.studfiles.ru/preview/2597603/ (accessed 7 March, 2016).
4. Friction-welding. Low cost, high yield: solutions with effective, powerful advice using friction to weld metals. http://www.welding-advisers.com/Friction-welding.html (accessed 27 April, 2016).
5. What is friction welding? http://www.wisegeek.com/what-is-friction-welding.htm (accessed 27 April, 2016).

VENTILATION SYSTEM AS A PERMANENT SOURCE OF ENERGY

Nurzhan E.
Tomsk Polytechnic University, Tomsk
Scientific supervisor: Kosheleva E.Y. PhD in History, associate professor, Department of Foreign Languages, Institute of physics and technology

The fan is called the machine, creating a pressure difference in the air line, which moves under the influence of air into the latter. Conventionally, to fans include machine creates a pressure difference of up to 10,000. The total length of the workings, which moves air in modern mines can reach 120 km, and their number is several hundred km. For the ventilation of large mines served 20-40 thousand m³ / min of air. The largest main fans have the impellers with a diameter of about 5 meters and engine capacity of up to 4000 kW. They create a pressure up to 9000 Pa at an air flow of 600 m³ / sec. It's very big power!

Vane wind turbines with horizontal axis are the most common type of wind turbines. Power wing turbine depends on the wind speed and scope of wind turbine blades.