Innovation, Sciences et Innovation, Science and CA 3088442 C 2024/06/18

Graphene Nanoplatelets Derived from Thermomechanical Exfoliation of Graphite

FIELD

The invention relates to graphene nanoplatelets and methods of preparing same.

BACKGROUND

Graphene is an atomic layer of sp^2 hybridized carbons atoms with exceptional mechanical, In one aspect, the invention provides a method comprising disposing a layered material into an

a chamber suitable for holding layered material; rotors located in the chamber such that the rotors

In one embodiment of the above machine aspect, the signal is provided when the volume of the

Fig. 8 shows a XPS spectrum of starting graphite material.

Fig. 9 shows a XPS spectrum of GNP product of the method described herein.

Fig. 10 [illegible]

As used herein, the term “XRD” refers to X-Ray Diffraction analysis.

As used herein, the term “PP” refers to polypropylene.

As used herein, the term “PA” refers to polyamide range of about 150 to about 250 °C, processing the material until a targeted increase in volume of releases a locking pin, followed by movement of portion of the chamber, for example, via a hydraulically

or pneumatically operated plunger or ram.

In one aspect, a machine is provided for preparing exfoliated material in a continuous process and exfoliated samples were recorded using a FEI MLA Quanta 650 FEG ESEM instrument that was slightly shifted to higher binding energy. GNP has a carbon content of 94 % (no other trace

elements) compared to 99 % for the graphite. Also, the atomic concentration of O is less than 5.44 %

PA/GNP and PA/F-GNP composites with improved flexural modulus were obtained when compared to

that of graphite/polyamide composite.

In one embodiment, a machine is described for preparing nanoplatelets. The machine includes a

WORKING EXAMPLES

Graphite (purity ≥97%) was purchased from Sigma Aldrich (Ontario, Canada) and used as on Si zero background plates. Analysis was carried out with Co Kα radiation (Fe filtered). 0.02 rad

incident beam soller, 15 mm mask, 1/8° divergence slit, 1° anti-scatter slit, and 0.02° diffracted beam soller which was neat PP). The flexural modulus of the composite with F-GNP (from the TME process) showed an improvement of nearly [illegible] relative to the composite from the CM process, see Fig. 11B

Table 1: Specific surface area and bulk density of [illegible]

Claims

1. A method, comprising:

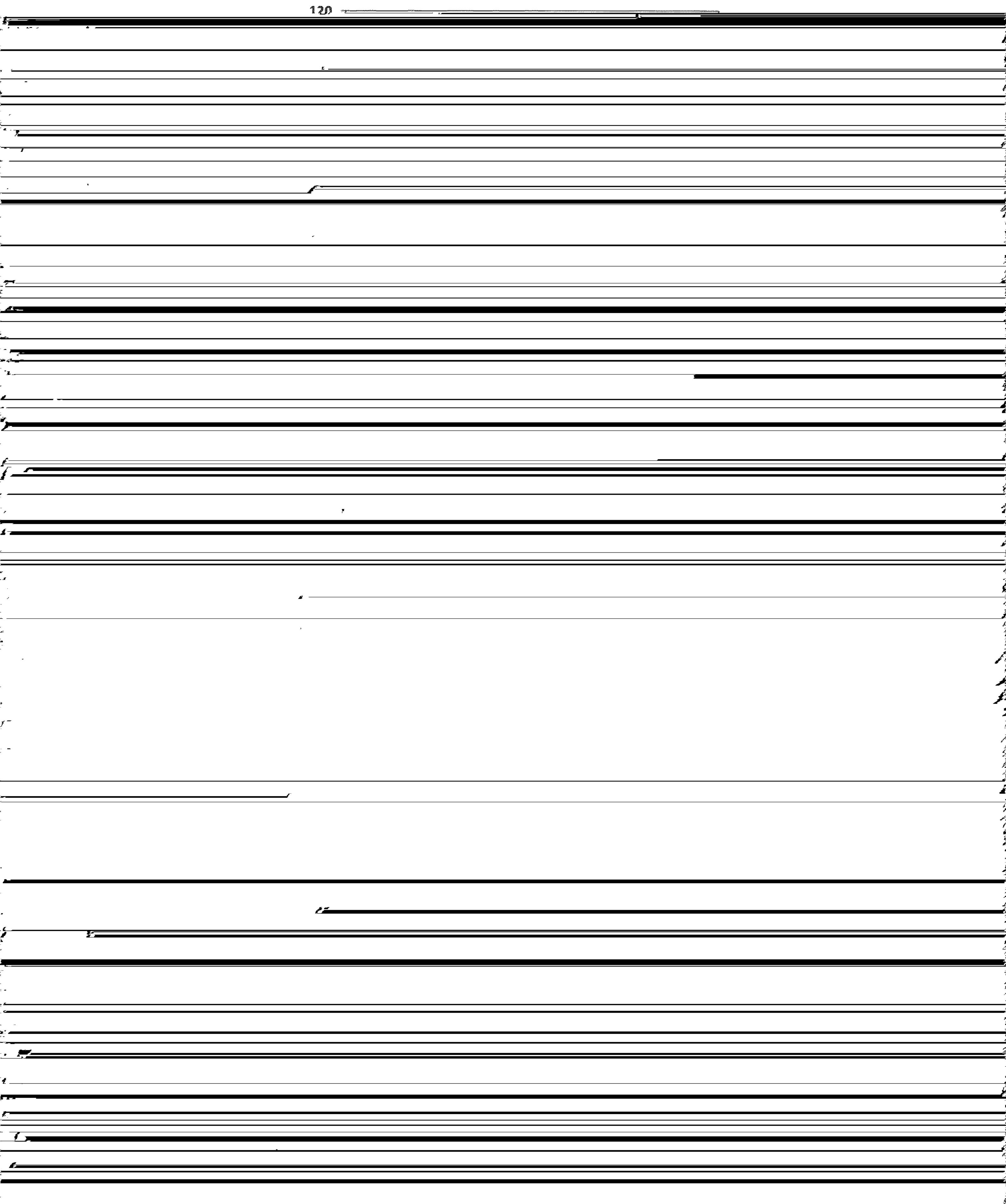
dispensing a layered material into an expandable chamber of a machine adapted

to apply a shear force:

8. The method of claim 1, wherein the shearing occurs for about 15 min to about 5 hours.

15. The machine of claim 10, wherein the at least one controller controls an operating

speed of the shearing element in a range of about 50 to about 150 rpm.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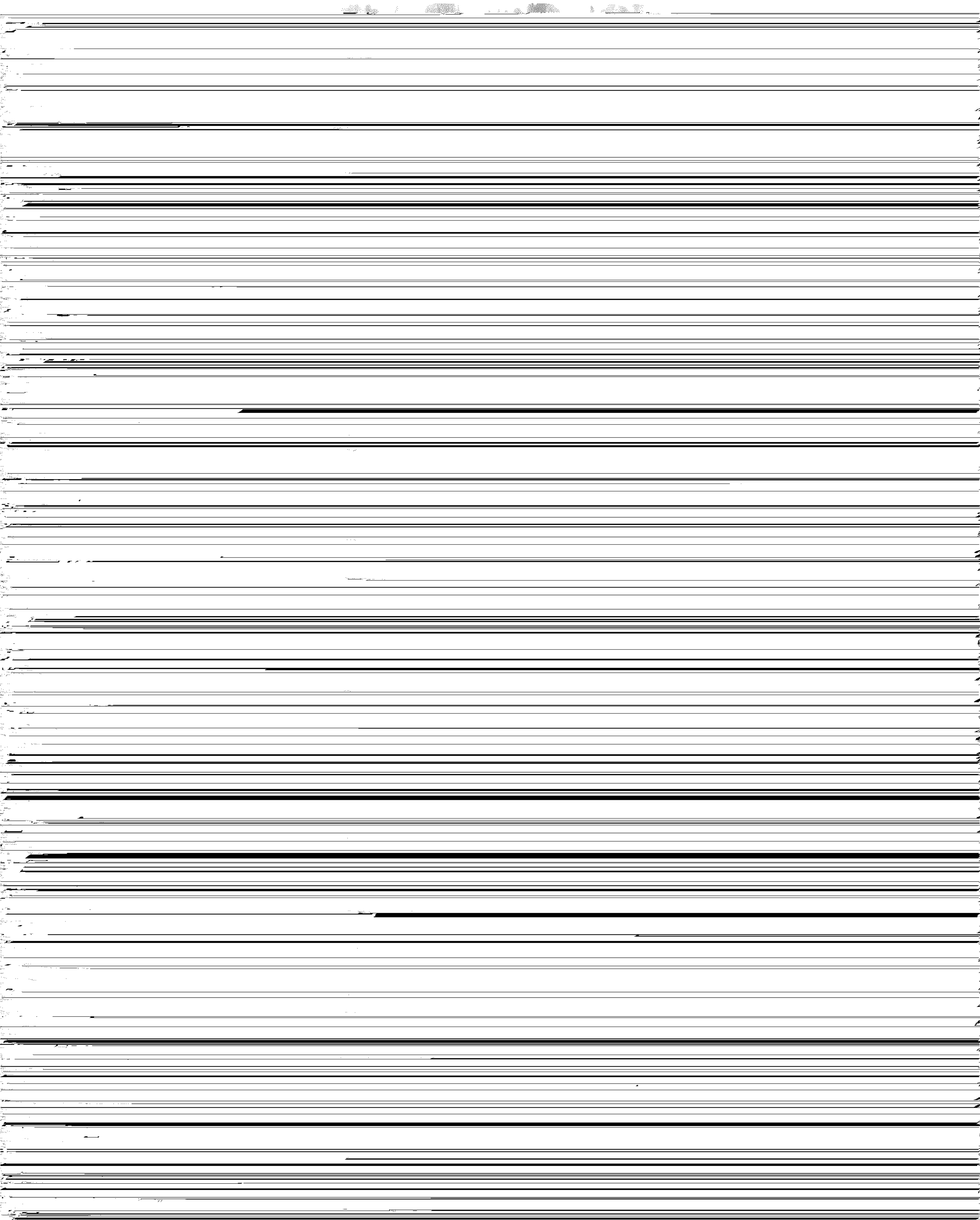

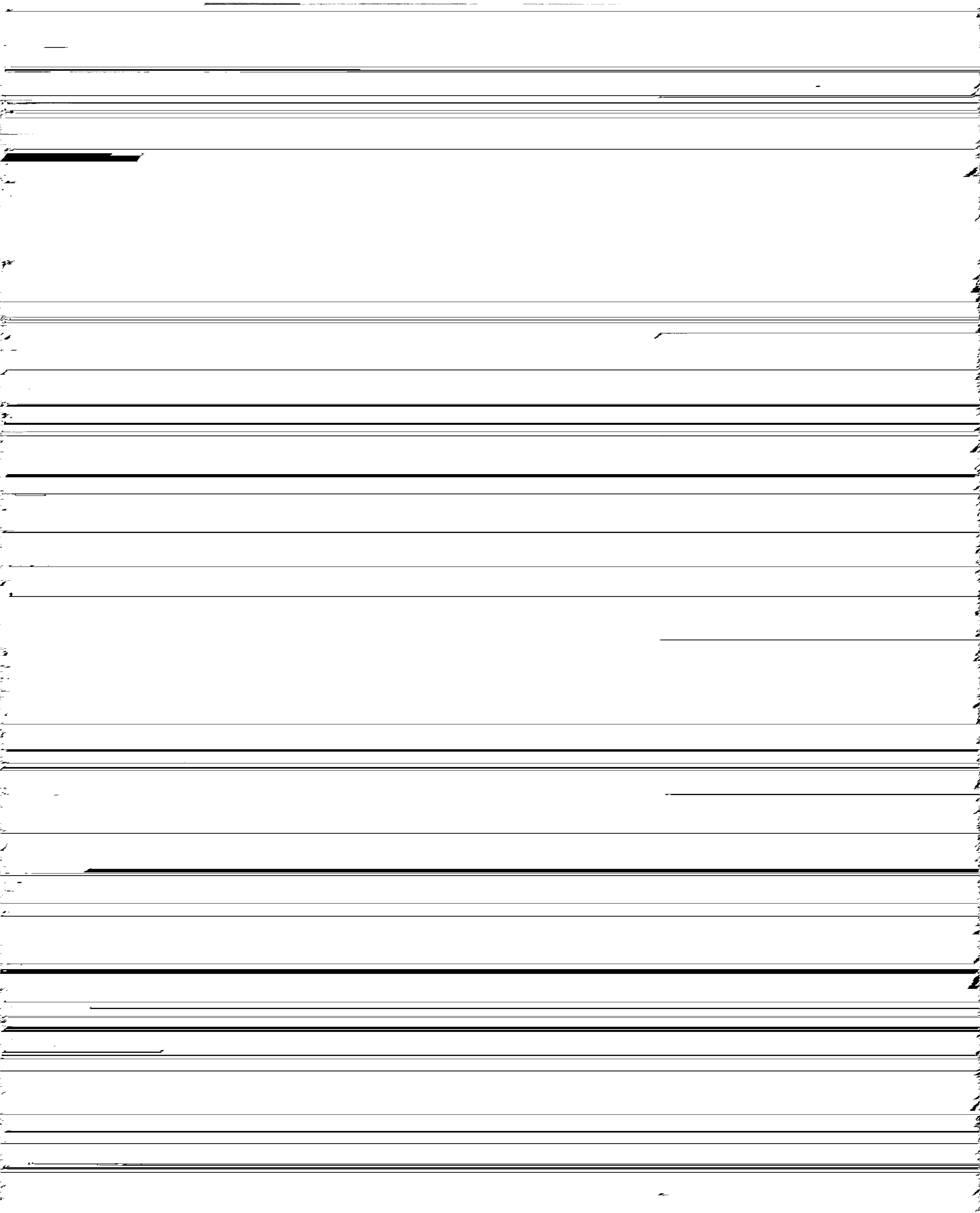

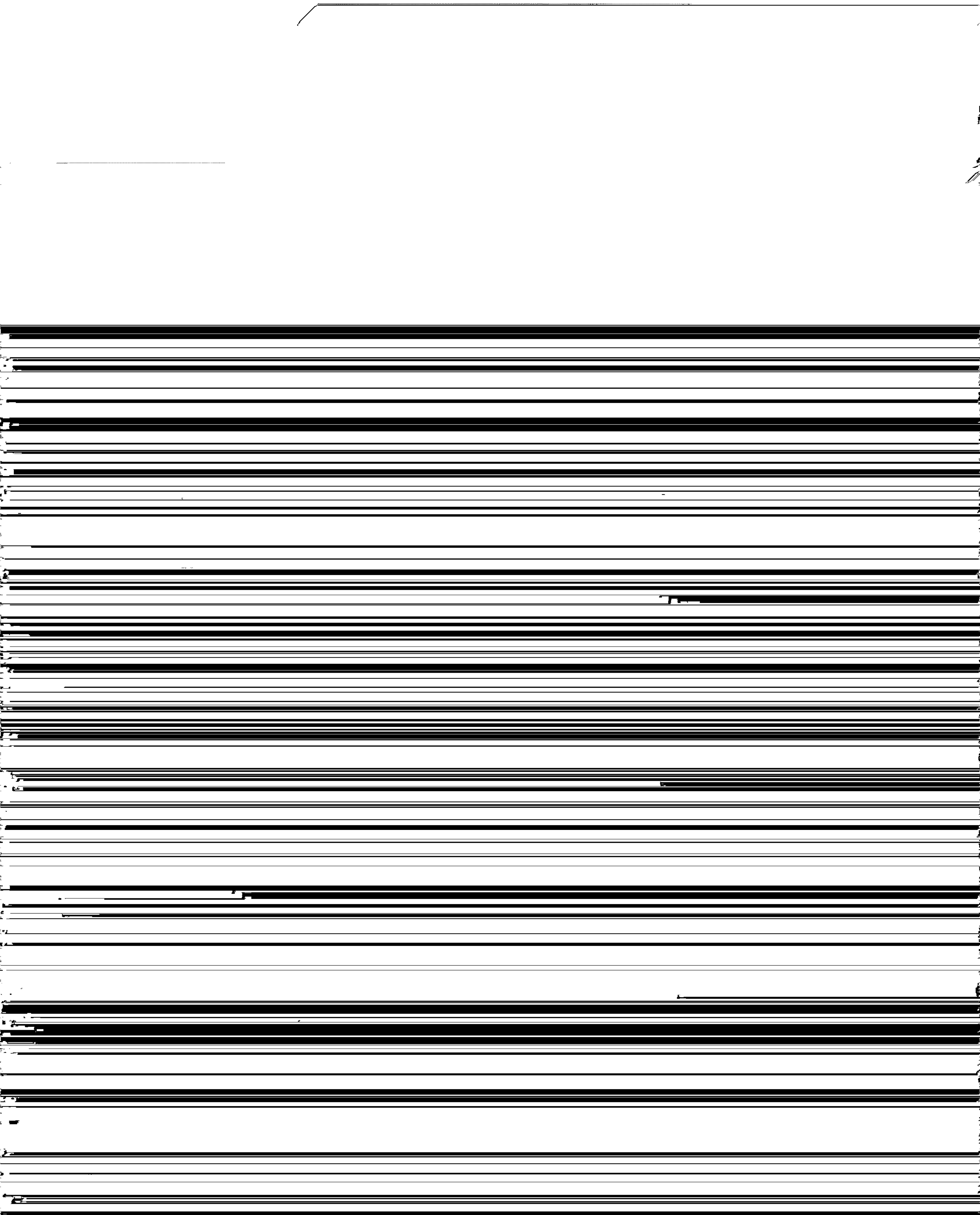

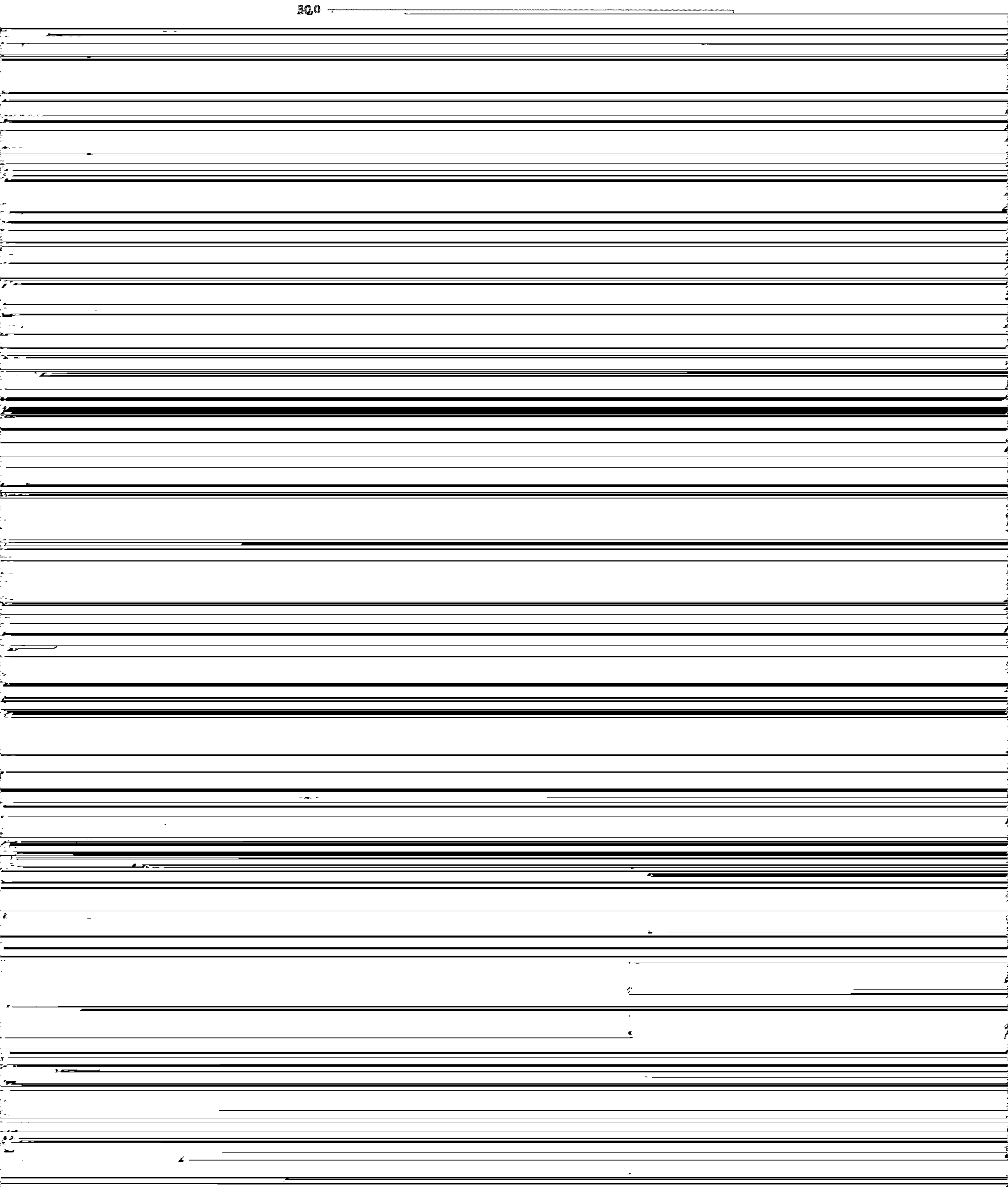
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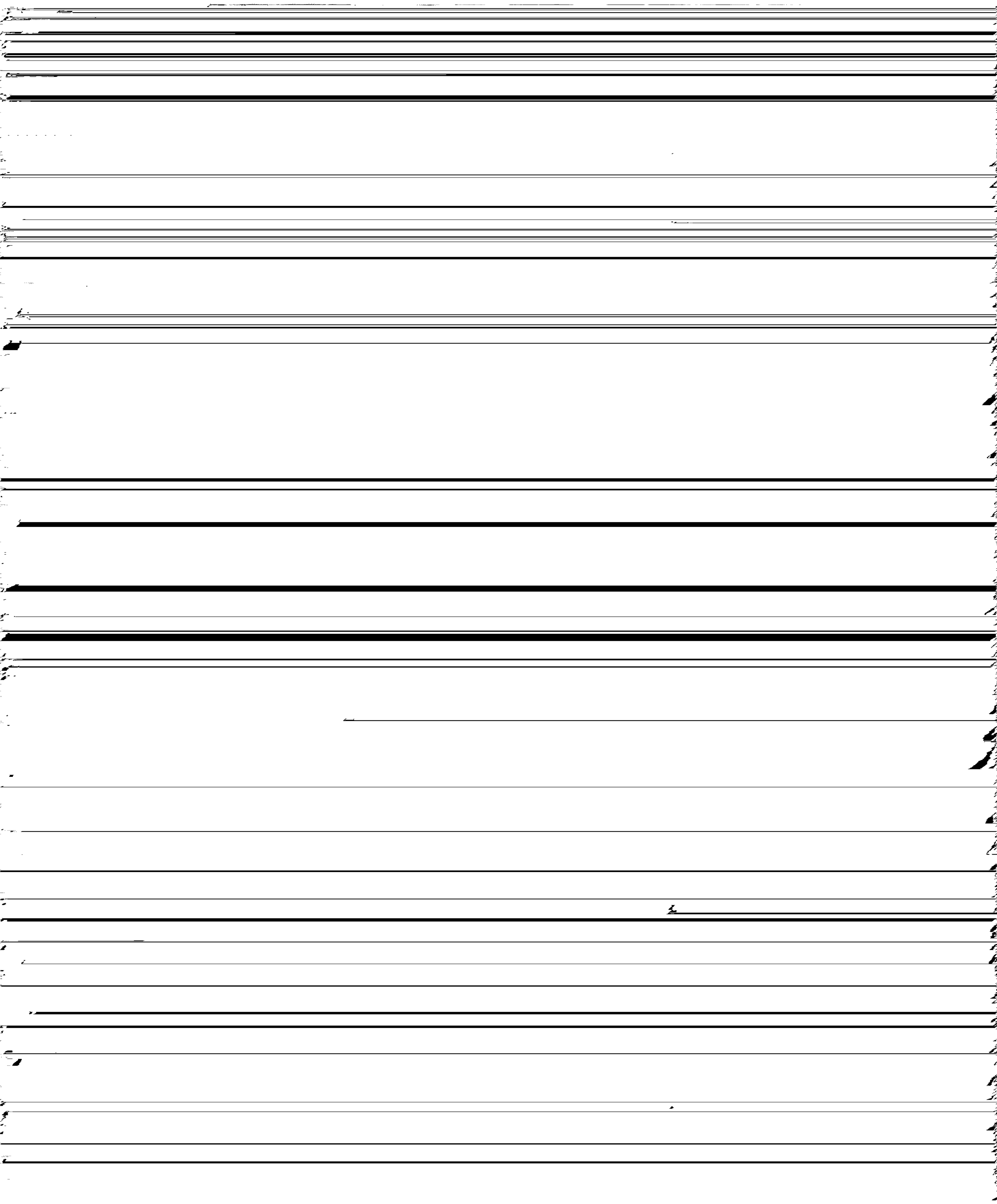

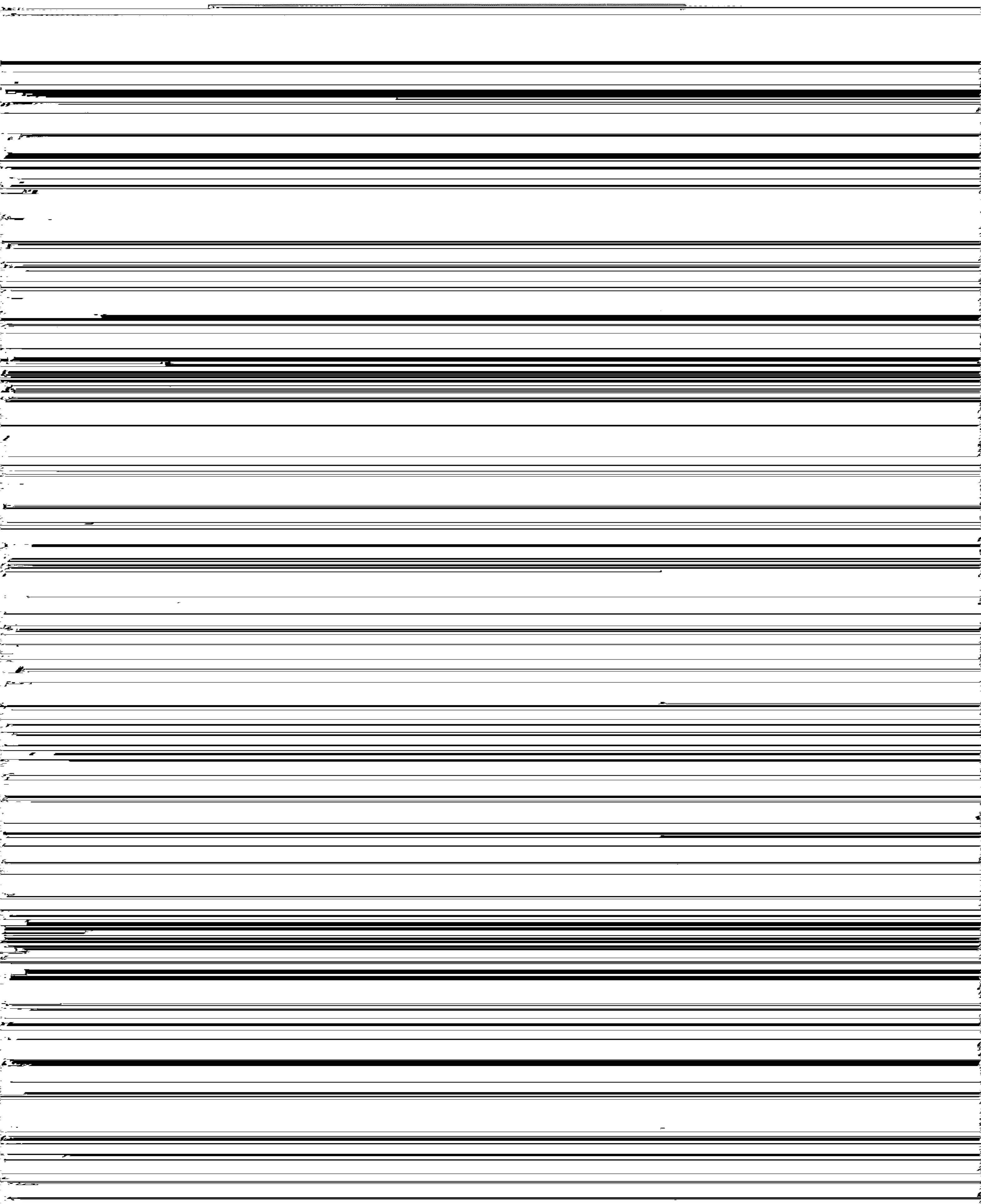

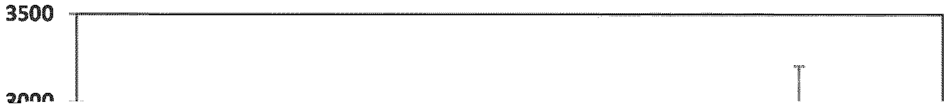
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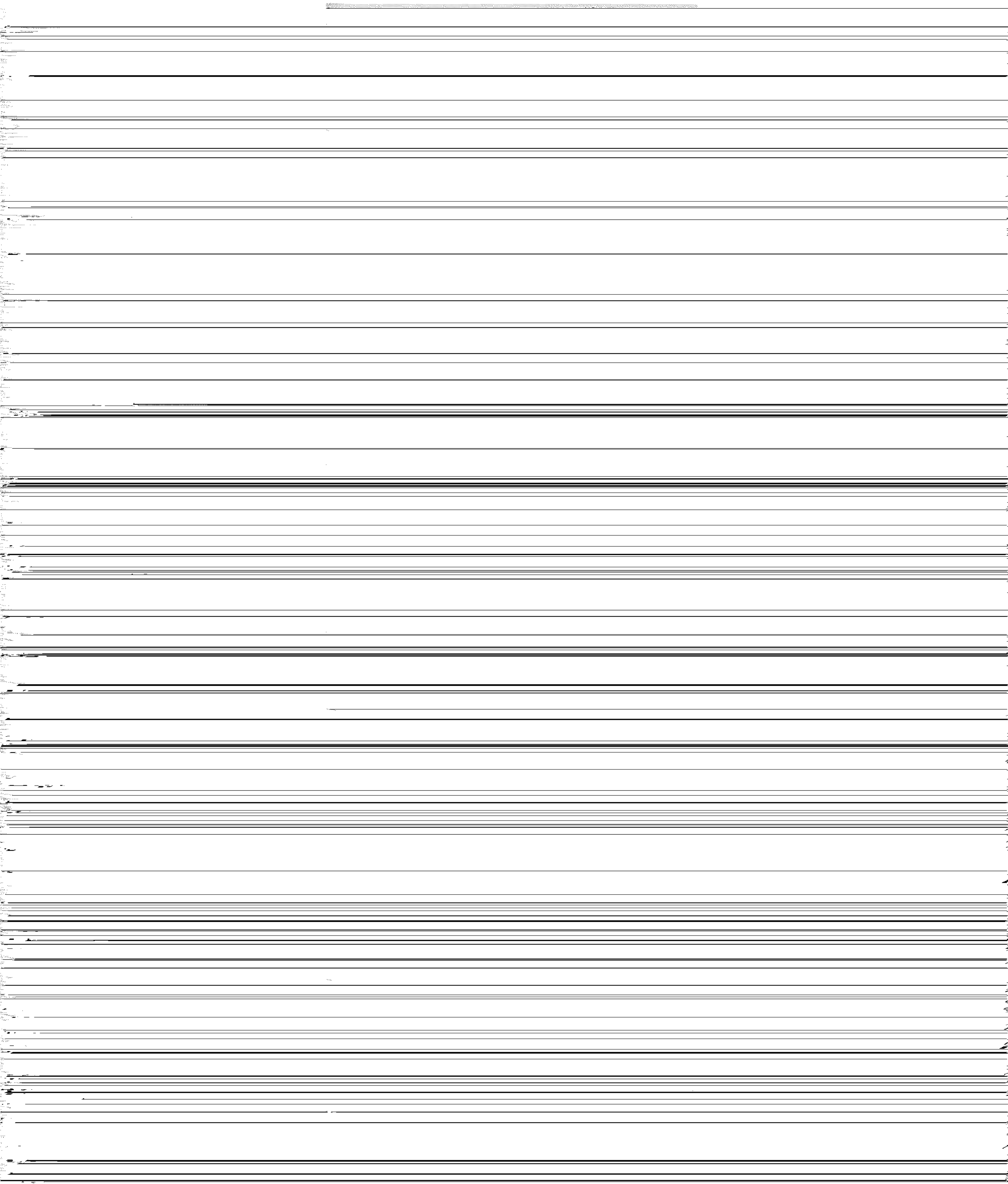

Abstract

A method of exfoliating layered, shearable material is described. Examples are provided including exfoliation of graphite to form graphene nanoplatelets. Also described is a machine for preparing nanoplatelets that includes a chamber whose volume can be increased by pressure exerted