Particle size measurment with distribution

IMAGE FORMAT CONVERSION FROM TIF TO JPG AND THEN CROPPING

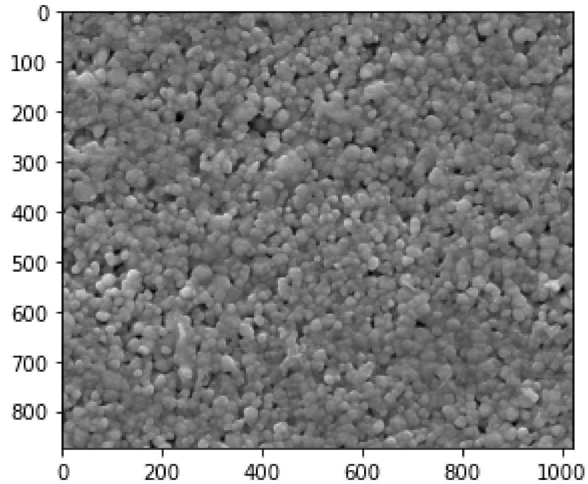
In [2]:
```
from PIL import Image

image_path='/Users/shivashankar/Downloads/grain_image/8/DS-115_003'

# Load the TIFF image
tiff_image = Image.open(image_path+'.tif')  # Replace 'input.tif' with your TI

# Save it as a JPEG image
tiff_image.save(image_path+'.jpg', 'JPEG')  # 'output.jpg' is the desired outp
```

In [3]:
```
# Importing Image class from PIL module
from PIL import Image

# Opens a image in RGB mode
im = Image.open(image_path+'.jpg')

# Size of the image in pixels (size of original image)
# (This is not mandatory)
width, height = im.size

# Setting the points for cropped image
left = 0
top = 0
right = width
bottom = height-70

# Cropped image of above dimension
# (It will not change original image)
im1 = im.crop((left, top, right, bottom))


# Shows the image in image viewer
im1.save(image_path+'.jpg')
```

THE ORIGINAL IMAGE

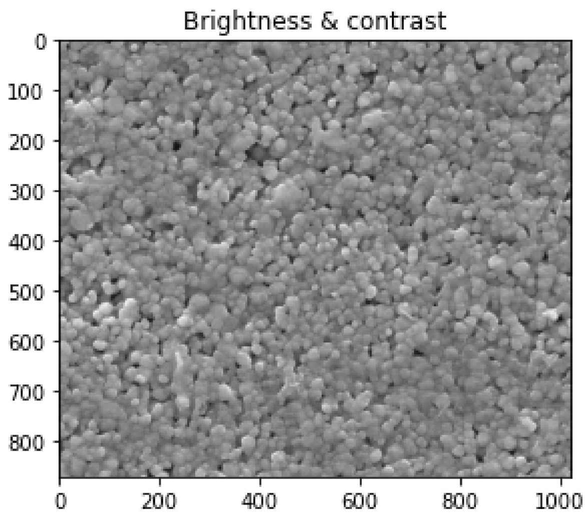
In [4]:
```
import cv2
import numpy as np
import matplotlib.pyplot as plt


image = cv2.imread(image_path+'.jpg',1)

plt.imshow(image)
#plt.savefig("/Users/shivashankar/Downloads/original.jpg")
```

Out[4]:
```
<matplotlib.image.AxesImage at 0x11658e2b0>
```



THE IMAGE AFTER BRIGHTNESS ADJUSTED

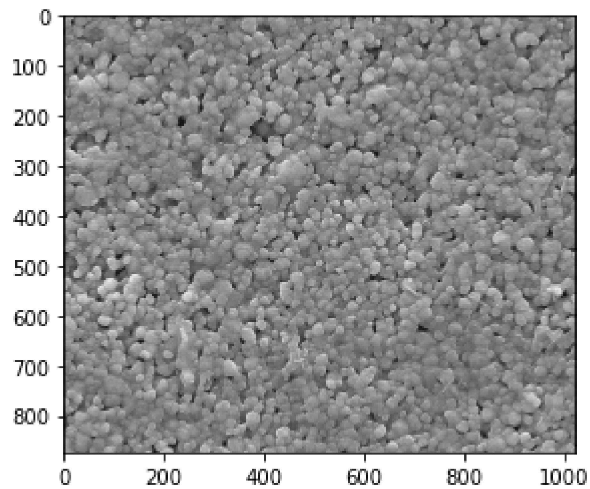
In [5]:
```
# Adjust the brightness and contrast
# Adjusts the brightness by adding 10 to each pixel value
brightness = 20
# Adjusts the contrast by scaling the pixel values by 2.3
contrast = 1

image2 = cv2.addWeighted(image, contrast, np.zeros(image.shape, image.dtype),


plt.title("Brightness & contrast")
plt.imshow(image2)
plt.show()
```



THE IMAGE AFTER SHARPENING

In [6]:
```
# Create the sharpening kernel
kernel = np.array([[0, -1, 0], [-1, 5, -1], [0, -1, 0]])

# Sharpen the image
image = cv2.filter2D(image2, -1, kernel)

plt.imshow(image)
#plt.savefig("/Users/shivashankar/Downloads/sharpened.jpg")
```

Out[6]:
```
<matplotlib.image.AxesImage at 0x1166bf580>
```



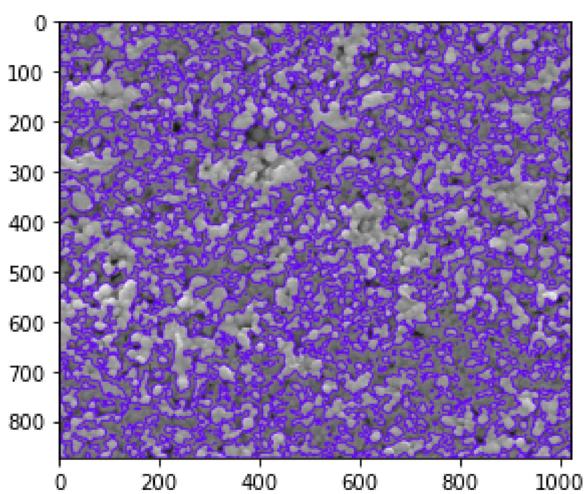
THE IMAGE AFTER BLURRING, THRESHOLDING TO SEPARATE PARTICLES, DRAW CONTOURS AROUND PARTICLES

In [7]:

```
# Convert the cropped image to grayscale
gray_cropped = cv2.cvtColor(image2, cv2.COLOR_BGR2GRAY)

# Apply Gaussian blur to reduce noise
blurred = cv2.GaussianBlur(gray_cropped, (5, 5), 0)

# Apply thresholding to segment particles
threshold_value, thresholded = cv2.threshold(blurred, 0, 255, cv2.THRESH_BINAR

# Find contours of particles
contours, threshold_value = cv2.findContours(thresholded, cv2.RETR_EXTERNAL, c

# Calculate particle diameters and collect them in a list
particle_diameters = []
for contour in contours:
    (x, y), radius = cv2.minEnclosingCircle(contour)
    diameter = radius * 2
    particle_diameters.append(diameter)

# Draw particle boundaries
cv2.drawContours(image2, contours, -1, (100, 0, 255), 2)  # Green color, thick

average_diameter = np.mean(particle_diameters)
print("Average Diameter of Particles:", average_diameter,"(pixels)")



# Display the cropped image with particle boundaries
plt.imshow(image2)
```

```
Average Diameter of Particles: 22.864645661164303 (pixels)
```

Out[7]: <matplotlib.image.AxesImage at 0x11674d700>



In [8]:
```
for i in range(len(particle_diameters)):
    particle_diameters[i]=round(particle_diameters[i],2)
```

In [9]:
```
particle_diameters.sort()
print(particle_diameters)
```

```
[0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
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3.61, 3.61, 3.61, 3.61, 3.61, 3.61, 3.61, 3.61, 3.61, 3.61, 3.61, 3.61, 3.61,
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09, 10.1, 10.2, 10.33, 10.44, 10.5, 10.63, 10.63, 10.77, 10.81, 10.82, 11.0,
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12.21, 12.51, 12.53, 12.53, 12.65, 12.67, 12.69, 12.7, 12.81, 12.81, 12.82, 1
2.9, 12.94, 13.0, 13.04, 13.04, 13.04, 13.04, 13.07, 13.08, 13.15, 13.15, 13.
42, 13.6, 13.84, 13.89, 13.89, 13.91, 13.98, 14.1, 14.14, 14.18, 14.18, 14.3
2, 14.32, 14.32, 14.42, 14.43, 14.43, 14.47, 14.77, 14.87, 14.87, 14.87, 14.9
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5.55, 15.67, 15.81, 15.81, 16.12, 16.12, 16.12, 16.12, 16.17, 16.17, 16.18, 1
6.19, 16.28, 16.28, 16.33, 16.55, 16.64, 16.76, 16.8, 16.98, 17.04, 17.13, 1
7.26, 17.26, 17.3, 17.49, 17.52, 17.52, 17.54, 17.72, 17.89, 17.91, 18.03, 1
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```

```
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6, 91.83, 92.82, 92.92, 93.61, 95.89, 96.4, 96.8, 96.88, 97.74, 101.83, 101.9
7, 104.8, 108.58, 109.02, 112.72, 115.13, 115.74, 122.67, 124.34, 126.87, 12
7.03, 129.99, 131.49, 136.96, 142.64, 148.19, 151.16, 154.49, 156.12, 158.51,
161.06, 167.62, 175.88, 190.38, 194.88, 195.21, 202.81, 207.99, 230.79, 237.5
7, 261.02, 274.61, 275.77, 278.15, 315.99, 358.93, 519.17]
```

In [10]:
```
temp=particle_diameters
```

In [11]:
```
print(len(temp))
```

```
823
```

In [12]:
```
temp_copy = temp[:]
for i in range(len(temp_copy)):
    if temp_copy[i] == 0.0 or temp_copy[i] >= 90 or temp_copy[i]<20:
        temp.remove(temp_copy[i])
```

In [13]:
```
print(len(particle_diameters))
```

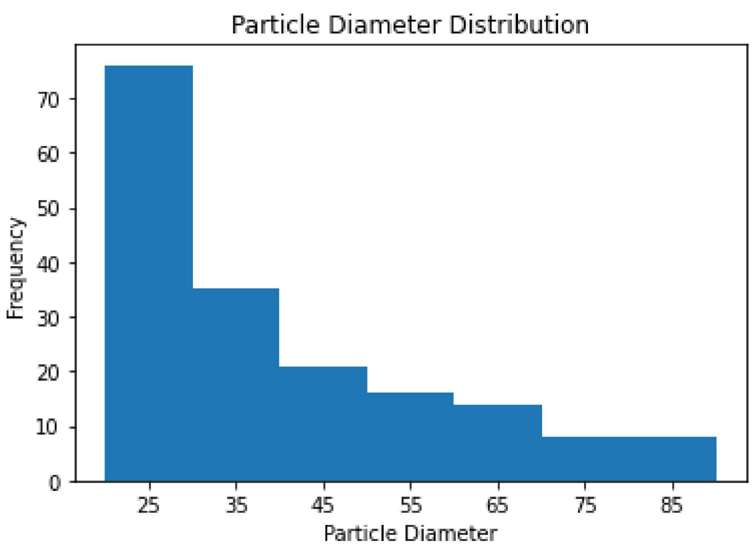
```
178
```

MEAN SIZE OF THE PARTICLE after excluding outliers and cluserters

In [16]:
```
print(np.mean(particle_diameters))
```

```
39.56837078651685
```

In [14]:
```
import matplotlib.pyplot as plt
import numpy as np


# Define the bins for particle diameter ranges
bins = [20, 30, 40, 50,60,70,80,90]  # Adjust these bins according to your dat

# Create a histogram of the particle diameters
hist, bins = np.histogram(particle_diameters, bins=bins)

# Calculate the midpoints of each bin for labeling the x-axis
bin_midpoints = [(bins[i] + bins[i + 1]) / 2 for i in range(len(bins) - 1)]

# Create the bar chart
plt.bar(bin_midpoints, hist, width=10, align='center')

# Label the axes
plt.xlabel('Particle Diameter')
plt.ylabel('Frequency')

# Set the x-axis ticks to be the midpoints of the bins
plt.xticks(bin_midpoints)

# Add a title to the chart
plt.title('Particle Diameter Distribution')

# Show the chart
plt.show()
```



In [145]:
```
# import matplotlib.pyplot as plt
# import numpy as np



# # Calculate the number of bins using the Freedman-Diaconis rule
# data_range = max(particle_diameters) - min(particle_diameters)
# print(data_range)
# bin_width = 2 * np.percentile(particle_diameters, 75) / (len(particle_diamet
# print(bin_width)
# num_bins = int(data_range / bin_width)
# print(num_bins)

# # Create the histogram
# plt.hist(particle_diameters, bins=num_bins, edgecolor='k', alpha=0.75)

# # Label the axes
# plt.xlabel('Particle Diameter')
# plt.ylabel('Frequency')

# # Add a title to the chart
# plt.title('Particle Diameter Distribution')

# # Show the chart
# plt.show()
```

In [ ]: